INSTRUCTION MANUAL

MODEL 130
FUNCTION GENERATOR
MODEL 131
VCG GENERATOR

WAVETEK

9045 BALBOA AVENUE, SAN DIEGO, CALIFORNIA

Serial No. ____________________

INSTRUCTION MANUAL

MODEL 130
FUNCTION GENERATOR
MODEL 131
VCG GENERATOR

WAVETEK

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2R-8/70

WARRANTY

All Wavetek instruments are warranted against defects in material and workmanship for a period of one year after date of manufacture. Wavetek agrees to repair or replace any assembly or component (except batteries) found to be defective, under normal use, during this period. Transfermatic Switch assemblies, manufactured by Wavetek, are unconditionally warranted for the life of the instrument. Wavetek's obligation under this warranty is limited solely to repairing any such instrument which in Wavetek's sole opinion proves to be defective within the scope of the warranty when returned to the factory or to an authorized service center. Transportation to the factory or service center is to be prepaid by purchaser. Shipment should not be made without prior authorization by Wavetek.

This warranty does not apply to any products repaired or altered by persons not authorized by Wavetek, or not in accordance with instructions furnished by Wavetek. If the instrument is defective as a result of misuse, improper repair, or abnormal conditions or operations, repairs will be billed at cost.

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NOTE

It is possible to adjust the controls, in the X1M range, beyond the specified limits of the generator and the instrument may stop oscillating. This condition is easily corrected by turning the frequency vernier control in a clockwise direction until oscillation again occurs. This condition is well below 1/1000th of the top of the dial.

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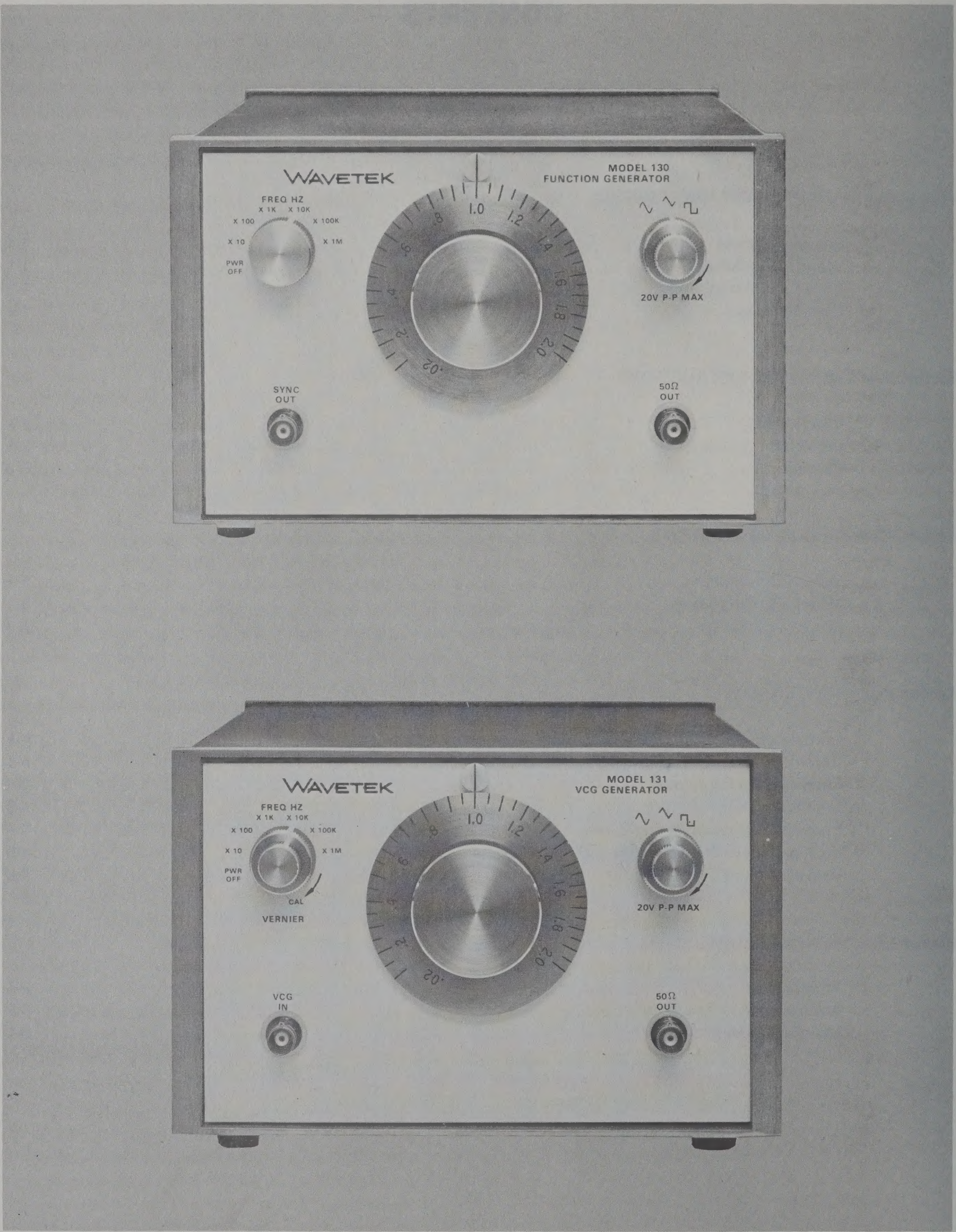


WAVETEK
MODEL 130
FUNCTION GENERATOR
FREQ HZ
X 1K
X 10K
X 100
X 100K
X 10
X 1M
PWR
OFF
20V P-P MAX
SYNC
OUT
50Ω
OUT
WAVETEK
MODEL 131
VCG GENERATOR
FREQ HZ
X 1K
X 10K
X 100
X 100K
X 10
X 1M
PWR
OFF
CAL
VERNIER
20V P-P MAX
VCG
IN
50Ω
OUT

8/70

SECTION 1
TECHNICAL CHARACTERISTICS

SCOPE OF MANUAL

This manual contains instructions for operating, testing, and maintaining the Wavetek Model 130 Function Generator and the Model 131 VCG Generator. The Wavetek product-improvement program ensures that the latest electronic developments are incorporated into the Wavetek instruments by the addition of circuit and component changes as rapidly as development and testing permit. Due to the time required to document and print these Instruction Manuals, it is not always possible to get these changes incorporated into the manual. In this case, data will be found on engineering change sheets at the back of the manual. If there are no change sheets, the manual is correct as printed.

SCOPE OF EQUIPMENT

The Model 130 and the Model 131 are precision sources of sine, square, and triangle waveforms. Both provide selectable and variable outputs over a dynamic frequency range of 0.2 Hz to 2 MHz. Both can be manually operated with easy-to-use, front-panel controls. The Model 131 is identical to the Model 130 in these aspects, but also offers frequency control by external voltage for either dc programming or wideband ac FM applications.

FUNCTIONAL DESCRIPTION

The basic generator circuitry (Figure 1-1) consists of the integrator and hysteresis/output switch and is common to both Model 130 and 131. The square wave from the output switch effectively controls the current flow at the summing node of the integrator. The integrator transforms the square wave into a triangle wave that is applied to the hysteresis switch. The hysteresis/output switch functions similarly to a Schmitt trigger with its limit points set far apart. When limit point is reached, the hysteresis/output switch fires and reverses the polarity of the square wave into the integrator, causing the triangle wave to also reverse direction. The result is a simultaneous generation of square and triangle waves of the same frequency, with the positive portion of the square wave coincident with the negative slope of the triangle.

Oscillation frequency is determined by a timing capacitor selected with the frequency range switch and the integrating current control. Maximum control voltage causes maximum integrating current, resulting in maximum frequency. For the Model 130, frequency is directly proportional to the square-wave amplitude appearing on the wiper of the frequency dial potentiometer. The Model 131 differs only by the inclusion of the VCG circuit. In this model, the square wave provides a gating function and frequency is proportional to the sum of the voltages from the frequency dial, frequency vernier control, and VCG input.

Sine conversion and the output amplifier are the same for both models. The output of the integrator, hysteresis/output switch, or sine converter is selectable with the function selector. The selected waveform is coupled through the output amplifier to the 50Ω OUT connector.

SPECIFICATIONS [1]

MODEL 130

VERSATILITY

Waveforms
Sine ∿, square ⊓⊔, and triangle ⋀⋁.

Dynamic Frequency Range
0.2 Hz to 2 MHz

Ranges

X10	0.2 Hz to 20 Hz
X100	2 Hz to 200 Hz
X1K	20 Hz to 2 kHz
X10K	200 Hz to 20 kHz
X100K	2 kHz to 200 kHz
X1M	20 kHz to 2 MHz

Outputs
Sine ∿, square ⊓⊔, and triangle ⋀⋁, selectable; amplitude variable over 40 db; 50Ω output impedance

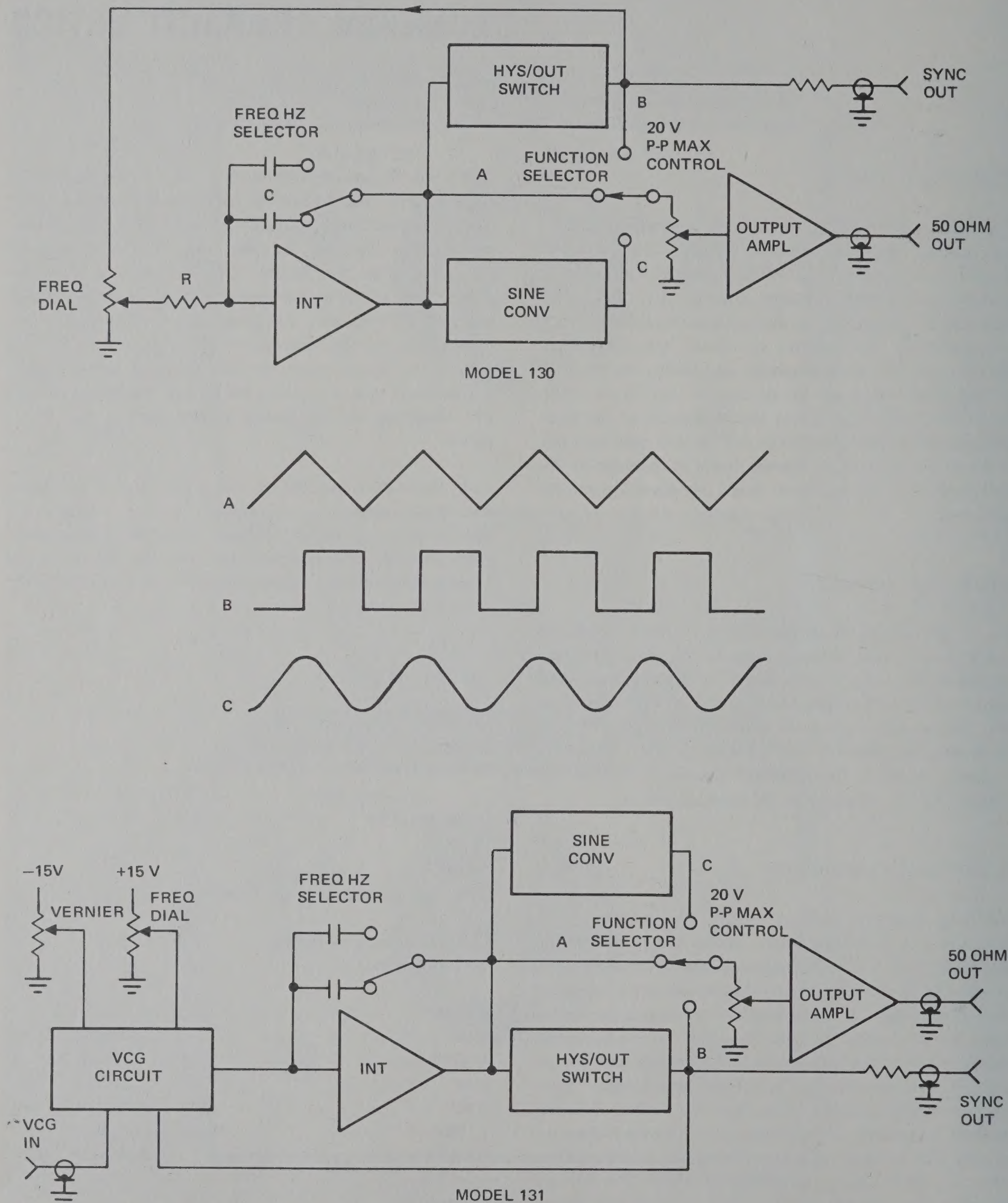


Figure 1-1 Functional Block Diagram

(600Ω available); 20 V p-p into open circuit and 10 V p-p into 50Ω load from 50Ω source impedance.

Sync Output
Greater than 1 V p-p square wave into open circuit at 600Ω output impedance.

DC Offset
±5 V offset (±2.5 V offset into 50Ω load) controlled from rear panel; peak amplitude limited by the dynamic range of the amplifier output.

Stability

Short term	±0.05% for 10 minutes
Long term	±0.25% for 24 hours

Percentages apply to amplitude, frequency, and dc offset.

HORIZONTAL PRECISION

Dial Accuracy
±2% of full scale, 1 Hz to 2 MHz.

Time Symmetry
±1% through X100K range.

VERTICAL PRECISION

Sine Wave Frequency Response
Amplitude change with frequency less than:
- 0.1 db from 0.2 Hz to 200 kHz
- 0.5 db from 0.2 Hz to 2 MHz

PURITY

Sine Wave Distortion
Less than:
- 0.5% on X10, X100, X1K, X10K ranges
- 1.0% on X100K range
- 2.0% on X1M range

Square Wave Rise and Fall Time
Less than 100 nsec.

ENVIRONMENTAL

Temperature
All specifications listed, except stability, are for 25°C ±5°C. For operation from 0°C to 55°C, derate all specifications by factor of 2.

MECHANICAL

Dimensions
8-1/2 inches wide, 5-1/4 inches high, 11-1/2 inches deep.

Weight
7 lb net, 10 lb shipping.

Power
105 V to 125 V or 200 V to 250 V, 50 Hz to 400 Hz. Less than 15 watts.

MODEL 131

VERSATILITY

Waveforms
Sine, square, and triangle.

Dynamic Frequency Range
0.2 Hz to 2 MHz

Ranges

X10	0.2 Hz to 20 Hz
X100	2 Hz to 200 Hz
X1K	20 Hz to 2 kHz
X10K	200 Hz to 20 kHz
X100K	2 kHz to 200 kHz
X1M	20 kHz to 2 MHz

Outputs
Sine, square, and triangle, selectable; amplitude variable over 40 db; 50Ω output impedance (600Ω available); 20 V p-p into open circuit and 10 V p-p into 50Ω load from 50Ω source impedance.

Sync Output
Greater than 1 V p-p square wave into open circuit at 600Ω output impedance.

DC Offset
±5 V offset (±2.5 V offset into 50Ω load) controlled from rear panel; peak amplitude limited by the dynamic range of the amplifier output.

VCG—Voltage Controlled Generator [2]
Frequency of generator may be dc-programmed or ac-modulated by external 0 to 5 V signal. Voltage control circuitry is capable of 1000:1 deviation. The VCG amplifier has a 100 kHz bandwidth and a slew rate of 0.1 V/μsec. The instantaneous frequency is the result of the sum of the dial setting and the externally applied voltage.

Stability

Short term	±0.05% for 10 minutes
Long term	±0.25% for 24 hours

Percentages apply to amplitude, frequency, and dc offset.

HORIZONTAL PRECISION

Dial Accuracy
±2% of full scale, 1 Hz to 2 MHz.

Time Symmetry
±1% through X100K range.

VERTICAL PRECISION

Sine Wave Frequency Response
Amplitude change with frequency less than:
- 0.1 db from 0.2 Hz to 200 kHz
- 0.5 db from 0.2 Hz to 2 MHz

PURITY

Sine Wave Distortion
Less than:
- 0.5% on X10, X100, X1K, X10K ranges
- 1.0% on X100K range
- 2.0% on X1M range

Square Wave Rise and Fall Time
Less than 100 nsec.

ENVIRONMENTAL

Temperature
All specifications listed, except stability, are for 25°C ±5°C. For operation from 0°C to 55°C, derate all specifications by factor of 2.

MECHANICAL

Dimensions
8-1/2 inches wide, 5-1/4 inches high, 11-1/2 inches deep.

Weight
7 lb net, 10 lb shipping.

Power
105 V to 125 V or 200 V to 250 V, 50 Hz to 400 Hz. Less than 15 watts.

NOTES

[1] All specifications apply for frequencies obtained when dial is between 0.1 and 2 and at 10 V p-p into a 50Ω load.

[2] It is possible to stop the generator from oscillating by applying a negative voltage when the dial is already set at minimum frequency. Inputs up to 100 V will not permanently damage the instrument, however.

SECTION 2
OPERATING INSTRUCTIONS

INSTALLATION

Converting to 230-Volt Line Power

Models 130 and 131 are shipped from the factory with the power transformer connected for 115-volt line power, unless ordered for 230-volt use. Converting a 115-volt unit for 230-volt operation is a simple matter:

1. Remove power cord.
2. Loosen two captive thumb screws on rear panel and remove panel.
3. The conversion switch is located on the chassis. Use a thin-bladed screwdriver to move the 115-230 switch to the 230 position.
4. Replace 1/4-ampere fuse with a 1/8-ampere fuse of the same type.

Connecting Signal and Chassis Grounds

The instrument is shipped from the factory with the signal ground floating above chassis ground, unless otherwise specified. A common signal/chassis ground can be obtained as follows:

1. Remove power cord.
2. Loosen two captive thumb screws on rear panel and remove panel.
3. Solder a jumper wire between the ground lugs (green wires) of the SYNC OUT connector and the power connector (Figure 2-1).

INSPECTION

The following procedures should be performed to assure the user that the instrument has arrived at its destination in proper operating condition. Complete calibration and checkout instructions are provided in Section 4 for determining if the instrument is within electrical specifications.

Checking Visually

After carefully unpacking the instrument, visually inspect the external parts for damage to knobs, dials, indicators, surface areas, etc. If damage is discovered, file a claim with the carrier who transported the instrument. Retain the shipping container and packing material for use in case reshipment is required.

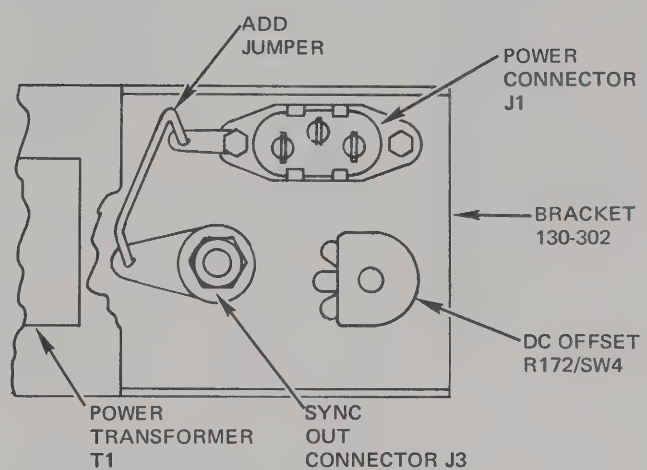


Figure 2-1. Common Ground Connection Diagram

Checking Electrically

NOTE

Refer to *Installation* paragraph for 115-volt or 230-volt line power instructions.

The procedural steps in this paragraph provide a quick checkout of instrument operation. If electrical deficiencies exist, refer to the *Warranty* in the front of this manual. The following test equipment, or equivalent, is recommended for performing this electrical inspection. (Refer to Table 2-1 and Figure 2-2 for operating control descriptions.)

Name	Manufacturer	Model
Oscilloscope	Tektronix	544
Counter-Timer	Monsanto	101A

MODEL 130

MODEL 131

Figure 2-2. Controls and Indicators

Table 2-1. CONTROLS, INDICATORS, CONNECTORS

Name	Description
MODEL 130 and 131	
FREQ HZ range selector	Selects frequency range from X10 to X1M in increments of 10. Line voltage applied to power supply in any range position. Also has power-off position.
Frequency dial	Selects frequency in continuously variable operation from 0.02 to 2.0; dial divisions in increments of 0.05.
Function selector	Selected sine, triangle, or square wave output.
20 V P-P MAX control	Adjusts output level from 100 mV to 10 V p-p (50Ω load).
Frequency index	Illuminated scribe line for setting frequency dial; lamp also indicates power applied.
50Ω OUT connector	Connects selected output waveform to load.
SYNC OUT connector	Connects output pulse for synchronizing applications.
DC OFFSET potentiometer	Adjusts baseline of output waveform over ±½ of full scale level.
MODEL 131 Only	
VERNIER frequency control	Provides fine tuning with 1% of full-scale range. When frequency dial is set at .02 (1/100 of range), VERNIER controls frequency to approximately .002 (1/1000 of range).
VCG IN connector	Connects 0 to ±5-volt dc programming or wideband ac input signal to VCG circuit.

1. Turn FREQ HZ selector to the X1K position. (This connects ac power to the unit and establishes the frequency multiplier.)
2. Connect oscilloscope to the 50Ω OUT connector with 50-ohm terminator.
3. Set frequency dial to the 1.0 mark.
4. Set function selector to ∿ .
5. Rotate 20 V P-P MAX control to its maximum clockwise position.
6. Check for 1-kHz sine wave with greater than 10 V p-p amplitude on oscilloscope.
7. Select ⋀⋁ and ⊓⊔ with function selector and check for 10 V p-p amplitude on oscilloscope.
8. Turn frequency dial from maximum counterclockwise to maximum clockwise positions and check for frequency change.
9. Rotate 20 V P-P MAX control from maximum clockwise to maximum counterclockwise positions and check for decreasing amplitude.
10. On the Model 131, rotate VERNIER control and check for frequency change.
11. On the Model 131 set VERNIER control at maximum cw. Set frequency to 20 Hz with counter. Connect a 0 to +5 Vdc input to the VCG IN connector. Slowly increase voltage input from 0 to maximum and check that frequency of output waveform increases from approximately 20 Hz to 2 kHz.

OPERATION

NOTE

One-half hour warmup is required for generator to stabilize at specified accuracies.

Operating as a Function Generator

The following instructions apply equally to the Model 130 and the Model 131, except as specifically noted.

1. Properly terminate 50Ω OUT connector.

NOTE

A 50-ohm termination results in 10 V p-p maximum output level. Open-circuit termination gives 20 V p-p. Loads between these limits provide intermediate maximum output levels.

2. Set the function selector to ∿ , ⋀⋁ , or ⊓⊔ .
3. Set FREQ HZ range selector to desired multiplier.
4. Set desired frequency dial mark under illuminated index.

NOTE

The Model 131 VERNIER control must be in full cw position for calibrated-frequency operation over the .1 to 2 dial range. If this control is in full ccw position, dial range is uncalibrated, but extended to approximately 1/1000 of full scale.

5. Set 20 V P-P MAX control for desired output level.

Operating as a VCG Generator

The following instructions apply *only* to the Model 131.

1. Properly terminate 50Ω OUT connector.
2. Set function selector to ∿ , ⋀⋁ , or ⊓⊔ as required.
3. Set FREQ HZ range selector to desired multiplier.
4. Connect external voltage source (dc programming or wideband ac signal) to VCG IN connector.

NOTE

VCG input requires 0 to ±5 volts for operation over full-scale range, but can withstand many times maximum input.

5. Set frequency dial as follows:
   a. For frequency modulation with ac input, set dial for center frequency.
   b. For increasing frequency sweep with positive dc input, set dial to lower frequency limit.
   c. For decreasing frequency sweep with negative dc input, set dial to upper frequency limit.

SECTION 3
CIRCUIT DESCRIPTION

GENERAL DESCRIPTION

Refer to the block diagram of the Model 130 Function Generator in Section 5. The Model 131 is more easily understood by first studying the Model 130.

A square wave is applied to the input of an integrator composed of a wideband differential dc amplifier, integrating resistor R, and capacitor C. The output of the integrator is fed into the hysteresis switch. The hysteresis and output switches function like a Schmitt trigger with the limit points set at the waveform extremes, firing when the triangle wave reaches +1.25 volts and −1.25 volts. The firing sets the hysteresis and the output switches which reverse the square wave fed into the integrator, causing the triangle wave to reverse direction. The result is simultaneous generation of a square wave and triangle wave of the same frequency with the positive half cycle of the square wave coincident with the negative slope of the triangle wave.

The frequency of oscillation is determined by the magnitude of capacitor C selected with the FREQ HZ switch and by the amplitude of the square wave fed into the integrating resistor R. The ±5 volt square wave is fed to the frequency dial potentiometer. Setting the potentiometer for maximum voltage, and thus maximum integrating current, produces an output at maximum frequency. Frequency is directly proportional to the square wave amplitude appearing on the arm of the frequency dial potentiometer.

The sine wave is produced by shaping the triangle wave. The triangle wave is fed into a shaping network composed of resistors and diodes. As the triangle wave voltage passes through zero, loading of the triangle wave is minimal and thus the slope is maximum. As the triangle wave voltage increases; diodes with current limiting resistors conduct, successively, causing the slope of the output to be less.

Since the diode break points are mathematically computed and fitted to the true sine shape, the resultant waveform is an almost pure sine wave. The circuitry is completely symmetrical about ground, using a complimentary pair of diodes on each break point. The sine wave produced by shaping is considerably less in amplitude than the triangle wave input and is thus amplified to be equal to the triangle wave.

The triangle wave output of the integrator, the sine wave output, and the square wave coupled through a divider are fed to the function selector switch. The switch is coupled to the attenuator which in turn drives the output power amplifier.

All instrument circuits, except the switch set and the power amplifier output stage, operate with regulated ±15 volt supplies. The switch set requires regulated ±6 volts. The power amplifier output stage requires unregulated ±22 volts.

MODEL 131 DIFFERENCES

Refer to the block diagram of the Model 131 Voltage Controlled Generator (Figure 3-1). Unique circuitry in the Model 131 permits the amount of current fed to the integrator summing node to be controlled by an analog voltage. Integrating resistors R and R/2 are precisely matched and connected through a set of matched IC diodes, which alternately connect the integrating resistors to the integrator summing node.

The VCG input and the frequency dial both drive an operational amplifier whose output is proportional to, but inverted from, the sum of the input voltages. The first operational amplifier drives the second operational amplifier which is designed for unity gain, but inversion about ground. As a result, a positive voltage appearing on the input causes a negative voltage at the output of the first amplifier and a positive voltage at the output of the second amplifer.

A negative square wave causes integrating current I through resistor R to be subtracted through resistor R/2, thus causing net integrating current I to flow out of the integrator summing node. A positive square wave voltage causes the diode in the current path through resistor R/2 to be switched off. Thus, only integrating current I flows through R into the summing node of the integrator.

The circuit would be complete and work accurately except for the small drop across the switching diodes. This drop is compensated for by a matching IC diode in the feedback loop of the operational amplifiers. The current through the compensating diodes is designed to equal the current through switching diodes. The switching IC diodes and the operational amplifiers must have good high frequency characteristics since square waves up to 2 MHz must be controlled. As a result, the basic circuitry is also capable of a wide band frequency modulation.

CIRCUIT DESCRIPTION

Integrator

Stages IC4, IC5, Q1, and Q2, which are shown on the Main Board schematic diagram, form a wideband dc integrator amplifier. the FREQ HZ switch selects the appropriate integrating capacitors for frequency ranging.

Stage IC4 is a Darlington-input pair for the inputs. Four transistors in IC4 are low current, high gain, wideband transistors which allow the inputs to operate with low source current. The output is taken off at the output of IC5 and coupled through push-pull emitter follower Q1/Q2. CR5 and CR6 provide the bias voltage for Q1 and Q2 to prevent crossover distortion. R28 allows the dc levels in the two sides of the amplifier to be balanced throughout. The triangle output is connected to the sine converter and fed through R51 to hysteresis switch Q6-Q11.

Hysteresis and Output Switches

The transistors in the hysteresis switch are connected to form a bistable switch. Either the Q6, Q7 side or the Q9, Q10 side can be on but not both at the same time. When the triangle positive slope reaches the firing level set by R56, the Q7 side turns on and the Q10 side turns off. The triangle starts its negative slope and when it reaches the firing level set by R59, the Q10 side turns on and the Q7 side turns off. The hysteresis switch is dc coupled to the bistable output switch made up of Q13 through Q16.

The 10 volt peak-to-peak square wave is fed through voltage divider R73/R182 to the SYNC OUT connector. The square wave is also coupled to the output amplifier through the function switch after the 10 volt peak-to-peak square wave amplitude is attenuated by R84 and R85.

Sine Converter and Amplifier

Wavetek Model 130-011 Sine Converter is a sealed sub-assembly which contains temperature-compensated, matched diodes and precise current-biasing resistive networks. When a precise triangle wave is fed into the shaping network through voltage divider R123 and R124, the subassembly shapes the triangle wave into a sine wave.

The positive portion of the triangle is set by R126 through pin 4 (+V) and the negative portion is set by R127 through pin 1 (−V). Therefore, the input to the sine amplifier is a sine wave terminated with a 50Ω load in the subassembly. The sine wave is fed directly to the plus input of the sine amplifier. Sine amplifier IC8 is a dc wideband operational IC amplifier connected in a potentiometric configuration. R131 is the feedback resistor. R128 adjusts the sine symmetry about ground and R133 adjusts the sine wave amplitude.

Output Amplifier

Q34 through Q40 form an operational output amplifier, connected in a potentiometric configuration, with a gain of approximately eight set by feedback resistors R145 and R151. Transistor Q34 is a differential input stage driving the second differential stage of Q37 and Q38. Q35 together with R141, R152, R153, Q36, CR18 form a constant current generator for the Q34 differential amplifier stage. Q36, connected as a diode, compensates for the base-emitter junction voltage change of Q34 due to temperature variations. R141, together with the divider formed by R152/R153, set the constant current output. CR18 compensates for the current output change due to the base-emitter junction voltage change of Q37 and Q38 caused by temperature variations. The output is taken off single ended at the collector of Q38 and coupled to the push-pull emitter follower Q39/Q40. Diodes CR16 and CR17 provide bias for the push-pull emitter follower to prevent crossover distortion. The output is coupled through R165, R166, R167, and R168 to 50Ω OUT connector. The input is selected on the front panel and is applied through SW3. The input is attenuated by amplitude adjustment potentiometer R135. The maximum attenuation is approximately 40 db. R172 serves as a dc offset control allowing the power amplifier output to be offset approximately ±5 V dc. (Using the offset control limits the available peak output signal.) The output will deliver 100 mA into a 50Ω load and 20 volts peak-to-peak into an open circuit. When terminated in 50 ohms, the amplifier will deliver 10 volts peak-to-peak. When the amplifier is offset maximum and terminated in 50 ohms, the output is limited to 5 volts peak-to-peak.

C64 allows the amplifier to be high-frequency compensated and is adjusted to give the best square-wave response without peaking when a 2 MHz square wave is applied. The unregulated ±22 volts dc provides the supply voltages for the push-pull emitter follower of the output amplifier. The

rest of the circuit operates on the regulated ±15 volts dc. R150 is the dc balance control, allowing the output to be adjusted for symmetry about ground.

Model 131 VCG Amplifiers

The two VCG amplifiers are similar operational inverting amplifier configurations (see Figure 3-1). The basic operational amplifier is a μA709C integrated circuit. IC1 is the first inverting operational VCG amplifier and is the main frequency control. The dial voltage from the dial potentiometer is applied through R4, R5, and R6 to the summing node of the operational amplifier.

The voltage from frequency VERNIER potentiometer R10 is applied through R9 to the summing node of the operational amplifier. Any voltage applied to the front panel VCG IN connector is applied through R3 to the summing node of the operational amplifier. The resultant output is proportional to the sum of the input voltages.

Resistors R11, R12, and R13 provide a zero adjustment network for the summing node of the operational amplifier. R7 and R8 provide source current for the input of the first amplifier, allowing frequency adjustment at the minimum of the dial. R14 is the feedback resistor in the first operational amplifier.

The square wave output from the output switch is applied through R16 to the anode of IC2d. When the square wave is negative, IC2d is turned off and the output of the first VCG amplifier is coupled through IC2b to the summing node of the integrator. R18, R19, and R20 form the first VCG amplifier integrating resistors.

When the square wave is positive, IC2d is turned on and biases the cathode of IC2b at ground potential, thus allowing no current to flow through IC2b. IC2c, in the feedback loop of the first operational amplifier, compensates for the voltage drop across IC2b. This also provides temperature compensation for the first VCG amplifier.

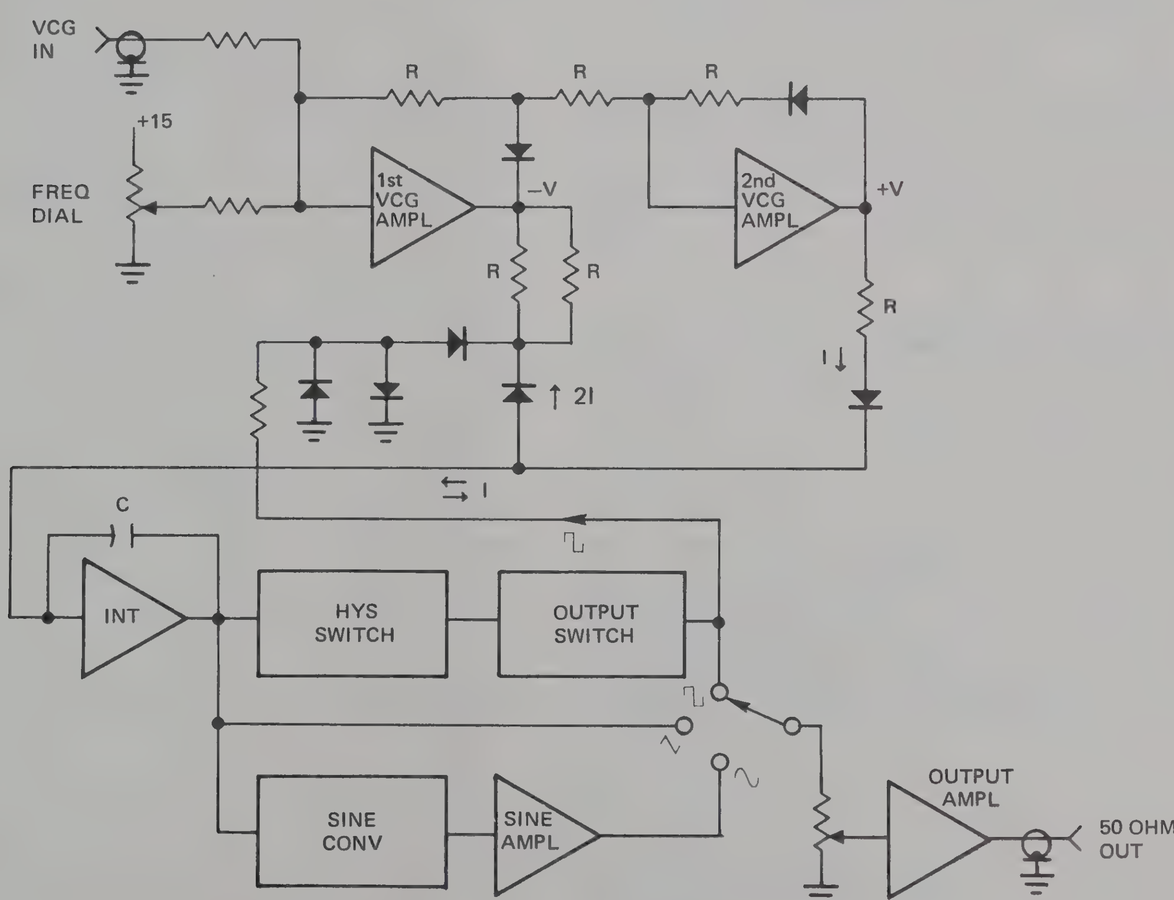


Figure 3-1. Model 131 VCG Block Diagram

The first operational amplifier has a gain of approximately 2/5 with respect to the dial input, and the second operational amplifier has a gain of unity. The output of the first VCG amplifier is coupled through R21 to the summing node of the second operational amplifier.

Resistor R181 is the feedback resistor in the second operational amplifier. IC2a and IC2f diodes, in the second operational amplifier, are compensation elements for temperature and diode voltage drop variations.

However, the output of the second operational amplifier is moving positive; therefore, the diode polarities are reversed. The output of the second VCG amplifier is always positive and connected to the integrator summing node through the second VCG amplifier integrating resistor R27 and the diode IC2a.

Since the second VCG amplifier has unit gain, it provides an output of opposite polarity and equal magnitude to that of the first VCG amplifier. The precise gains of the VCG amplifiers and the precise integrating currents are obtained by matching R14, R18, R19, R21, R27, and R181.

A negative square wave at the anode of IC2d causes the integrating current through R27 to be subtracted through R18 and R19, and thus causes the net integrating current to flow out of the integrator summing node. A positive square wave voltage causes IC2b to be switched off. Thus, integrating current through R27 flows into the summing node of the integrator.

Resistors R22, R23, and R24 serve as the zero adjustment control for the second VCG amplifier. R22 allows adjustment of the time symmetry at the minimum of the dial.

Power Supply

AC voltage is coupled from the transformer secondary to the bridge rectifier CR11-CR14. Filtering is provided by C48 and C49. Q25 is a transistor connected and operated as a zener diode to provide a reference voltage for the +15 volt supply. IC6 is a comparator differential amplifier. IC6 drives a Darlington-connected pass transistor pair, Q17 and Q18. The pair is formed for added current gain. Q20 is a transistor connected and operated as a zener diode to provide a voltage level shift for the IC6 output. R104 allows the minus input of IC6 to be adjusted slightly negative with respect to the plus input, which has a zener voltage of approximately 6.3 volts. R104 is adjusted to give an output of +15.0 volts. If the +15.0 volts tries to increase due to a change in line voltage or load current, the connector of Q25 stays approximately at the same voltage. Thus, the minus input of IC6 becomes more positive than the plus and the IC6 output draws more current. The output moves less positive and this change is coupled through Q20 to the bases of Q17 and Q18. This returns the supply to +15.0 volts.

IC7 is a comparator differential amplifier in the −15.0 volt regulator. The plus input of IC7 is referenced to ground through R107. The divider of matched resistors, R106 and R108, between the plus and minus 15 volt supplies sets the minus input of IC7 precisely at ground. An increase in −15.0 volts due to line voltage variation or load current variation results in the minus input of IC7 moving negative. The IC7 output moves less negative (in a positive direction). This change is coupled to the bases of Q23 and Q24 through Q21. Q23 and Q24 form a Darlington-connected pass transistor pair for added current gain. The positive going change returns the output to −15.0 volts.

Q19, with R90 through R92, from a foldback current limiter for +15 volt regulator. Normally, the base of Q19 is biased more negative than the emitter and Q19 is turned off. Thus, the base of Q18 moves freely as IC6 output changes. When the +15 volt output is overloaded, heavy current flows through R90 and creates a potential drop across the resistor. When the potential drop overcomes the drop across R91, Q19 begins to conduct, thus starting to short the base of Q18 to the +15 volt output. In this condition, the output can be shorted indefinitely at lower than the maximum power dissipation of Q17. When the overload condition is removed from the +15 volt output, the base of Q18 starts to rise. As the emitter of Q17 rises toward +15 volts, the divider R91 and R92 has more effect on the base of Q19 and eventually turns off Q19 completely. When it turns off, the normal condition is restored. Q22, with R93 through R95, form a foldback current limiter for the −15 volt regulator.

SECTION 4
MAINTENANCE

INTRODUCTION

This section provides instructions for testing, calibrating, troubleshooting, and repairing the Model 130 and Model 131. The instructions are concise and for the experienced electronics technician or field engineer. Wavetek maintains a factory-repair department for those customers not possessing the necessary personnel or test equipment to maintain the instrument. If an instrument is returned to the factory for calibration or repair, a detailed description of the specific problem should be attached to facilitate the turnaround time. Test point and adjustment locations are illustrated in Section 5.

RECOMMENDED TEST EQUIPMENT

Table 4-1 contains a list of recommended test equipment. Any test equipment having equivalent accuracies may be substituted for those listed.

Table 4-1. TEST EQUIPMENT

Name	Required Characteristics	Recommended Manufacturer	Model
Oscilloscope	To 30 MHz	Tektronix	544
Plug-In	Dual channel	Tektronix	1A1
Plug-In	Peak mV measuring capability	Tektronix	1A5
Distortion Analyzer	To 600 kHz	Hewlett-Packard	334A
Spectrum Analyzer Display	To 50 MHz	Hewlett-Packard	141S
IF Section		Hewlett-Packard	8552A
RF Section		Hewlett-Packard	8553L
Dialamatic Voltmeter	Millivolt dc measurement	Wavetek	201
Counter	To 10 MHz	0.1% of reading accuracy	

CHECKOUT AND CALIBRATION

The following paragraphs provide complete sequential calibration procedures for the Model 130 and Model 131. Instrument checkout procedures are indicated by a check-mark (√) following the procedure title. A quick checkout of the instrument can be performed by comparing the indicated parameters with the tolerances given in the **Specifications** of Section 1.

NOTE

The entire calibration procedure *must* be read first to determine initial control settings and test equipment connections before attempting checkout.

Preliminary Procedures

1. Set FREQ HZ selector to the X1K position and VERNIER control maximum cw.
2. Allow one-half hour for warmup.

Power Supply Regulation

1. Connect voltmeter between TP1 (common) and TP2 (+) on Main Board. Adjust R104 for +15 Vdc ±100 mV.
2. Connect voltmeter between TP1 (common) and TP3 (–). Since the negative supply is referenced to the +15-volt supply, the voltmeter should indicate –15 Vdc ±100 mV.

Square Wave Amplitude Symmetry

1. Set function selector to ⊓⊔ .
2. Connect oscilloscope, with 1A5 plug-in, to coaxial-wire lug on function switch.
3. Adjust R121 until square-wave negative peak is equal to amplitude to positive peak ±5 mV.

Output Amplifier √

1. Connect oscilloscope to 50Ω OUT connector with 50-ohm terminator (⊓⊔ function).
2. Set FREQ HZ selector for X1K (VERNIER full cw) and frequency dial at 2.0.
3. Turn 20 V P-P MAX control fully ccw.

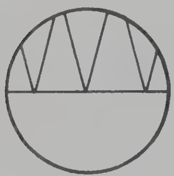
4. Adjust R150 for amplitude symmetry about ground.
5. Set FREQ HZ selector for X1M (2.0 dial setting).
6. Turn 20 V P-P MAX control fully cw.
7. Adjust C64 for best square-wave response without peaking.

First VCG Null √

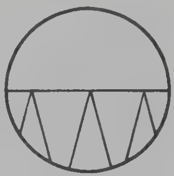
1. Connect oscilloscope to 50Ω OUT connector.
2. Set FREQ HZ selector to X1K. Set dial at 1/100 of full scale.
3. Short and open VCG IN to signal ground (outside of BNC connector) while monitoring output frequency variation. Adjust R11 for minimum frequency change.

Triangle Amplitude

1. Set frequency dial for 2.0 (X1K range) and function selector to ∿ .
2. Connect oscilloscope, with 1A5 plug-in, to red-wire lug on function switch.
3. Adjust R56 on main board for positive peak at +1.25 volts ±5 mV (see sketch).
4. Adjust R59 for negative peak at −1.25 volts ±5 mV.



Negative Peak



Positive Peak

Time Symmetry √

1. Connect unit and oscilloscope, with 1A1 plug-in set for alternate display, as shown in Figure 4-1.
2. Set FREQ HZ selector for X100K with VERNIER (Model 131) in full cw position (⎍ function).
3. Set frequency dial for 2 kHz on oscilloscope (1/100 dial FS).
4. Adjust R28 for time symmetry at 100:1 frequency ratio.

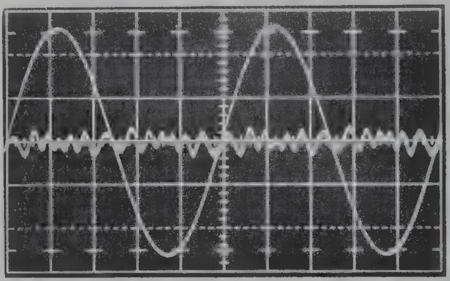
NOTE

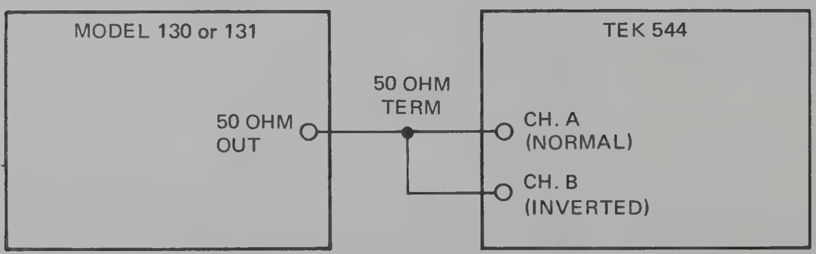
Steps 5 and 6 below do *not* apply to the Model 130.

5. Turn VERNIER fully ccw and adjust R22 for time symmetry at 1000:1.
6. Repeat Steps 4 and 5, as necessary, for optimum symmetry at 100:1 and 1000:1.
7. Check for waveform time symmetry at the .2 and 2 frequency-dial settings.

Sine Distortion, Amplitude, and Balance √

1. Set FREQ HZ selector for X1K (VERNIER full cw), function selector to ∿ , and frequency dial at 2.0.
2. Connect oscilloscope, with 1A5 plug-in, to orange wire on function switch.
3. Adjust R128 to balance output.
4. Adjust R133 to obtain 2.5 V p-p ±25 mV output.
5. Connect the unit, distortion analyzer, and oscilloscope as shown in Figure 4-2.
6. Adjust R126 and R127 for minimum sine distortion (see photo).





Trigger:	Internal
Display:	Alternate
Time Base:	50 microseconds/cm for 1/100 of 200 kHz 500 microseconds/cm for 1/1000 of 200 kHz

Figure 4-1. Time Symmetry Measurement for Test Setup

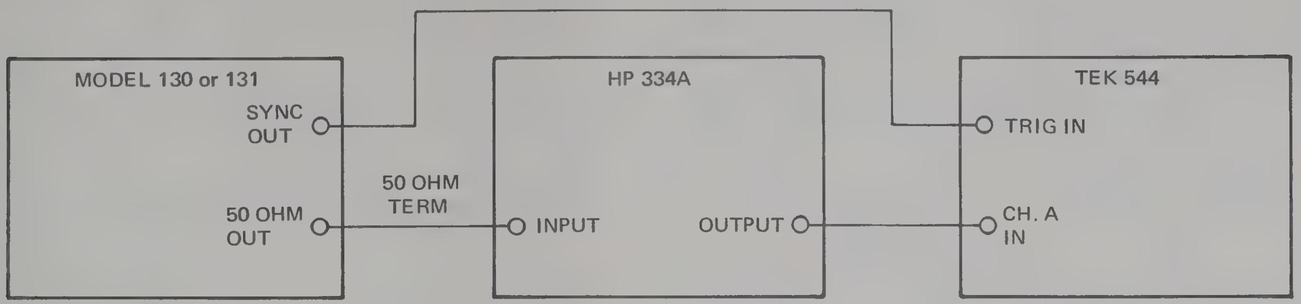


Figure 4-2. Distortion Analysis Test Setup

7. Set FREQ HZ selector to X10K.
8. Repeat Step 6 for Steps 1 and 7 to obtain least distortion at both X1K and X10K ranges.
9. Repeat Steps 2, 3, and 4.
10. Connect spectrum analyzer to unit as shown in Figure 4-3. Check sine distortion at 2 MHz.

Frequency Dial Alignment √

1. Connect counter to 50Ω OUT connector.
2. Set FREQ HZ selector to X10K and VERNIER fully cw.
3. Set frequency dial potentiometer for 2 kHz on the counter display.
4. Align 0.2 dial mark with the dial indicator index and tighten set screw.
5. Align 2.0 dial mark with the dial indicator index and adjust R4 (Model 131) or R173 (Model 130) to obtain maximum dial accuracy on bottom four ranges.
6. Set FREQ HZ selector to X100K and dial fully cw.

NOTE
Delete Steps 7-10 for Model 130.

7. Turn frequency VERNIER fully ccw.
8. Adjust R8 for 150 ±20 Hz on counter.
9. Check that generator continues to oscillate over the full range of the frequency VERNIER dial. If not, readjust R8.
10. Turn VERNIER full cw (CAL).
11. Set frequency dial to align 2.0 with index mark.
12. Adjust C16 to obtain 200.0 kHz on counter display.
13. Set FREQ HZ selector to X1M. Adjust C12 to obtain 2.00 MHz on counter display.

TROUBLESHOOTING

Basic Techniques

Troubleshooting the Model 130 or Model 131 requires no special technique. Listed below are a few reminders of basic electronics fault isolation.

1. Check control settings carefully. Many times an incorrect control setting, or a knob that has loosened on its shaft, will cause a false indication of a malfunction.
2. Check associated equipment connections. Make sure that all connections are properly connected to the correct connector.

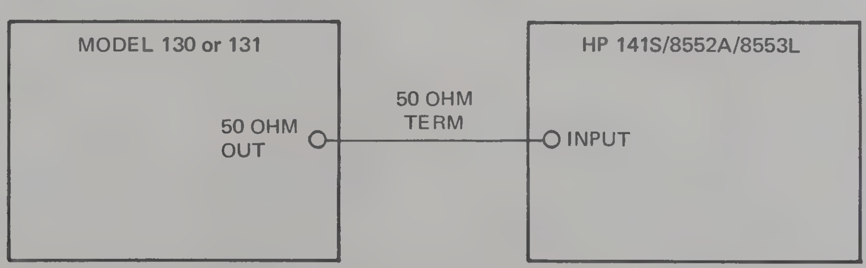


Figure 4-3. Spectrum Analysis Test Setup

3. Perform the checkout procedure. Many out-of-specification indications can be corrected by performing specific calibration procedures.
4. Visually check the interior of the instrument. Look for such indications as broken wires, charred components, loose leads, etc.

Troubleshooting Chart

Table 4-2 provides a list of possible malfunction symptoms, their probable causes, and the prescribed remedies. Also listed in this table are the test points at which measurements are to be made and the parameter tolerances at these points. To use the troubleshooting chart, locate the symptom listed in Column 1 and follow the corresponding procedures. Localize the fault to a specific stage by checking the parameters given for the major test points. Then check the dc operating voltages at the pins of solid-state devices. Check associated passive elements with a high input impedance ohmmeter (power off) before replacing a suspected semiconductor element.

Troubleshooting Hints

The interactive nature of a closed loop presents a somewhat special problem when approached from a troubleshooting standpoint. The simplest way to reduce problem complexity is to open the loop, thereby removing the interaction. The basic units of the loop can then be tested individually. The following step-by-step procedure describes how this is done. (The generator loop is all contained on the Main Board.)

1. Set instrument controls for 20 V p-p, 2 kHz sine-wave output.
2. Check at coaxial-wire lug of function selector switch for a 2.5 V p-p square wave. If normal, check output amplifier (Q34-Q40).
3. Unsolder and lift the end of R51 (TP7). This is the output of the integrator and input to the hysteresis switch. The generator loop has now been opened.
4. Inject a 2.5 V p-p triangle waveform into the hysteresis switch input lead (TP7).
5. Check at the coaxial-wire lug of the function selector switch for a 2.5 V p-p square wave at the injected frequency.
   a. If present, hysteresis and output switches are okay. Proceed to Step 6.
   b. If abnormal, check Q6-Q16 stages.
6. Vary frequency dial from ccw to cw while observing TP11 with a scope. Voltage at this point should remain at 0 volts throughout dial rotation. If a voltage variation is observed, check IC1 stage.
7. Vary frequency dial from ccw to cw while observing TP4. Voltage reading should vary from 0 to approximately −6 volts. If voltage does not vary, check IC2 stage and IC1 stage.
8. Vary frequency dial from ccw to cw while observing TP9. Voltage reading should remain at 0 volts. If voltage varies check IC3 stage.
9. Vary frequency dial from ccw to cw while observing TP10. Voltage should vary from 0 volts to approximately +6 volts. If voltage does not vary, check IC2 stage and IC3 stage.
10. Vary frequency dial from ccw to cw while observing TP8. Voltage reading should remain at 0 volts. If voltage varies, check IC4 and IC5 stages.
11. Re-install R51.

REMOVAL OF DUST COVERS AND PANELS

1. To gain access for calibration or maintenance, proceed as follows:
   a. Remove power cord.
   b. Loosen the two knurled captive screws on the rear panel.
   c. Pull off the rear panel.
   d. Remove the cover.
2. To gain access to any part mounted on bracket assembly behind rear panel, proceed as follows:
   a. Remove rear panel and dust cover as described in Step 1 above.
   b. Remove one heat-sink mounting screw.
   c. Remove bottom transformer mounting-block screw.
   d. Remove the two screws, lock washers, and hexnuts holding two wafers of FREQ HZ switch to bracket assembly.
   e. Remove four bracket-assembly retaining screws.
   f. Carefully pull bracket assembly to rear to obtain working room. Enough slack is available in the wiring for all normal operations.
3. To remove the front panel, proceed as follows:
   a. Remove rear panel and dust cover as described in Step 1 above.
   b. Remove all knobs, *except* frequency dial.

NOTE

Recalibration of the frequency dial is *not* required if the frequency dial is *not* removed.

   c. Unsolder BNC connections.
   d. Tag and unsolder frequency-dial potentiometer leads.
   e. Pull light bulb from indicator lens.
   f. Remove four front-panel retaining screws.
   g. Carefully pull off front panel with frequency dial/potentiometer still attached.

Table 4-2. TROUBLE SHOOTING CHART

Symptom	Probable Cause	Corrective Procedures
No outputs at 50Ω OUT connector	Blown fuse	Replace F1 a. 1/4A—115 Vac b. 1/8A—230 Vac
	Power supply	Check TP1/TP2 for +15V; TP1/TP3 for −15V; TP1/TP5 for +6V; TP1/TP6 for −6V. Troubleshoot associated regulator.
	Output amplifier	Check at wiper (grn/wht wire) of function selector switch for waveform as selected by position of switch. a. If waveform is present, troubleshoot output amplifier. b. If no waveforms are present, refer to **Troubleshooting Hints.**
No sine wave output	Sine amplifier	Check for 260 mV p-p sine wave at pin 4 of IC8. a. If present, check IC8 circuit. b. If *not* present, check A1 circuit. *NOTE*: Triangle wave must be present at pin 2 of A1 to obtain sinewave output.
No triangle, sine, or square wave	Generator loop	Refer to **Troubleshooting Hints**.
All waveforms low in amplitude	Power amplifier	a. Check front-panel amplitude control. b. Perform balance adjustment for power amplifier.
	Power supply	Check for proper voltages.
Frequency out of tolerance	Power supply	Check for proper power supply voltages as stated above.
	Maladjustment	Perform calibration procedure.
Sine wave not in spec	Maladjustment	Perform **Sine Distortion, Amplitude**, and **Balance** adjustment.
	Sine converter	Check for 260 mV p-p sine wave at pin 4 of IC8. a. If normal, check sine amplifier IC8. b. If abnormal, check A1 circuit.
Time symmetry of waveforms not correct	Maladjustment	Perform **Time Symmetry** and frequency adjustments.

REPLACEMENT OF SWITCH WAFERS AND POTENTIOMETERS

1. To replace FREQ HZ switch wafer C or D or the VERNIER (Model 131 only) potentiometer, proceed as follows:
   a. Remove rear panel and dust cover as previously described.
   b. Separate bracket assembly from chassis as previously described.
   c. Tag and unsolder leads to part being replaced.
   d. Pull defective part off shaft and repair or replace with recommended replacement part.
2. To replace FREQ HZ switch wafer A or B, proceed as follows:
   a. Remove rear panel and dust cover as previously described.
   b. Remove front panel as previously described.
   c. Tag and unsolder wires to switch wafers A and B.
   d. Unsolder wafer B PC-tabs from printed circuit board.
   e. Lift switch shaft slightly to free PC-tabs, rotate switch shaft so wafers clear board parts, and pull shaft end free of rear-mounted wafers C and D.
   f. Repair or replace defective part.
3. To repair or replace function selector wafers or 20 V P-P MAX potentiometer, proceed as follows:
   a. Remove rear panel and dust cover as previously described.
   b. Loosen set screws holding potentiometer and switch knobs to inner and outer shafts and remove knobs.
   c. Tag and unsolder wires to defective part.
   d. Unsolder potentiometer PC-tabs, lift shaft slightly to free tabs, rotate switch shaft so wafers clear board parts, and pull switch/potentiometer assembly out of front panel hole.
   e. Repair or replace defective part.

REPLACEMENT OF SINE CONVERTER

1. Remove rear panel and dust cover as previously described.
2. Unsolder the five pins of sine converter A1 from top of the printed circuit board, using a solder syringe.
3. Lift assembly from bottom of the board; a thin pencil-type soldering iron can be used, if necessary, to apply temporary heat during removal.

SECTION 5
DATA PACKAGES

INTRODUCTION

This section contains data packages for the Model 130 and Model 131. Each data package is a quick-access document, containing maintenance data arranged for convenient viewing of the schematic diagram and all supporting data. Each data package includes a parts-location illustration; a replaceable parts list; voltage/waveform data; and a schematic diagram. Voltage and waveform data are provided on the diagrams at indicated test points as an aid to troubleshooting. Also, included in this section are a list of manufacturers, block diagram, and outline drawing.

ARRANGEMENT

Drawings and data packages are arranged in this section in the following order:

Title	Drawing No.
130 Series Outline Drawing	130-601
Model 130 Block Diagram	130-600
Model 131 Block Diagram	131-600
130 Series Chassis Assembly	130-000
130 Series Main Board Data Package	130-010 and 130-210
130 Series Assembly Bracket	130-001

LIST OF MANUFACTORERS

AmericanRadionics . . . . . American Radionics, Inc.
Danbury, Connecticut

Amp . . . . Amphenol Connector Division
Broadview, Illinois

ARCO . . . . Arco Electronics
Great Neck, L.I., New York

Boots . . . . Boots-Townsend Aircraft
Santa Ana, California

Corn . . . . Corning Glass Works
Bradford, Pennsylvania

CRL . . . . Centralab
Division of Globe-Union
Milwaukee, Wisconsin

CTS . . . . Chicago Telephone Systems
Los Angeles, California

Electro . . . . Electro Cube, Inc.
San Gabriel, California

Elco . . . . Elco Corp.
Willow Grove, Pennsylvania

Erie . . . . Erie Technological Products Inc.
Erie, Pennsylvania

Fair . . . . Fairchild Semiconductor Corporation
Palo Alto, California

IMB . . . . IMB Electronics Products
Santa Fe Springs, California

IRC . . . . IRC Inc.
Philadelphia, Pennsylvania

Kings . . . . Kings Electronics Co., Inc.
Tickahoe, New York

Littelfuse . . . . Littelfuse Inc.
Des Plaines, Illinois

Motorola . . . . . Motorola Semiconductor Products
Phoenix, Arizona

RCA . . . . RCA Semiconductor Division
Somerville, New Jersey

Richey . . . . Richey Electronics
Nashville, Tennessee

Semtech . . . . Semtech Corporation
Newbury Park, California

HHSmith . . . . Herman H. Smith, Inc.
Brooklyn, New York

Sprague . . . . Sprague Electric Company
North Adams, Massachusetts

Stack . . . . Stackpole Carbon Company
St. Marys, Pennsylvania

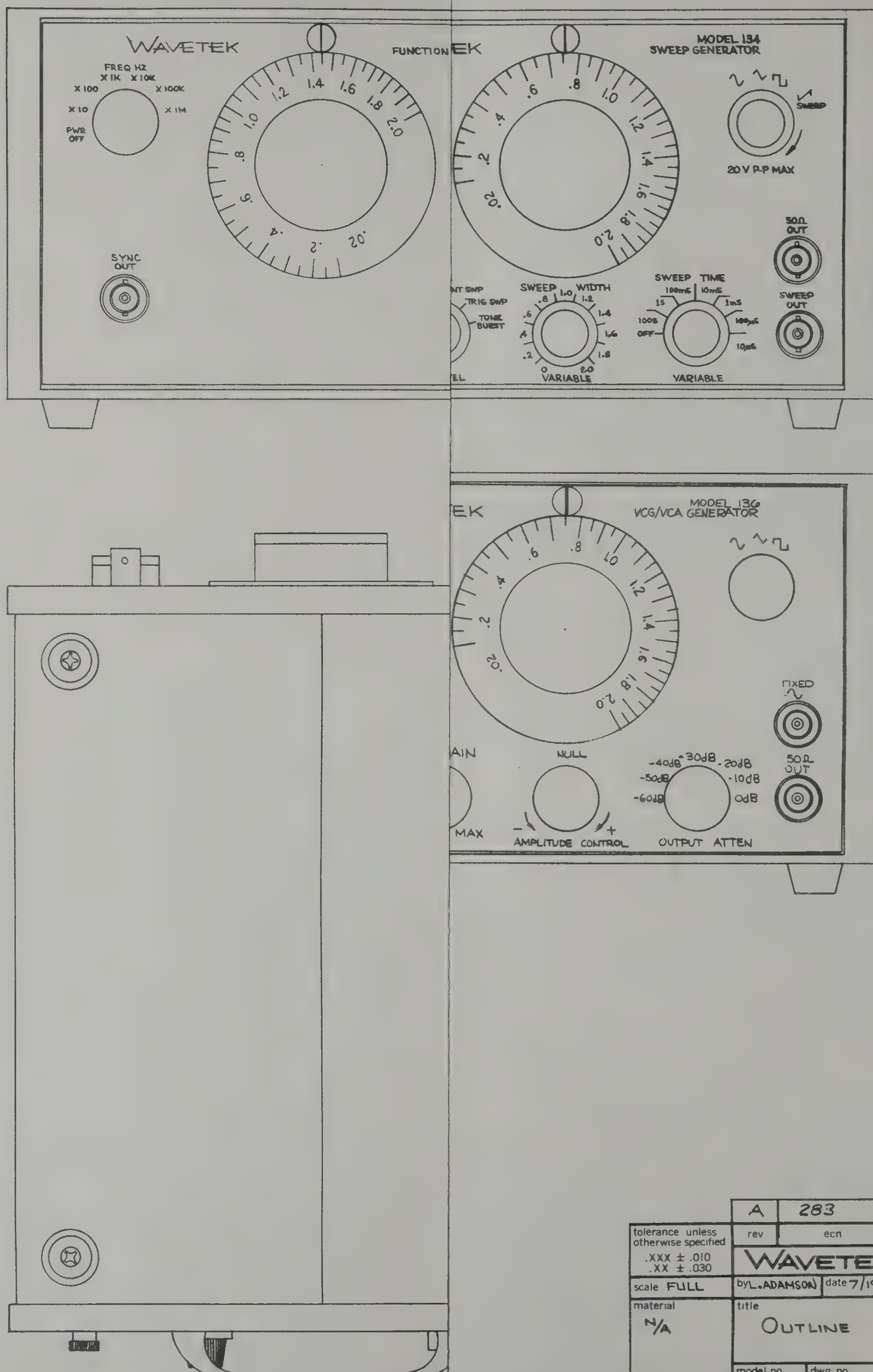
Switchcraft . . . . Switchcraft, Inc.
Chicago, Illinois

TI . . . . Texas Instruments, Inc.
Dallas, Texas

USECO . . . . USECO Inc.
Mt. Vernon, New York

Wakefield . . . . Wakefield Engineering, Inc.
Wakefield, Massachusetts

Wavetek . . . . Wavetek
San Diego, California



Bottom View (Typ)

A	283	B.	11-11-69	
rev	ecn	by	date	app.

tolerance unless otherwise specified .XXX ± .010 .XX ± .030	WAVETEK san diego, calif
scale FULL	by L.ADAMSON date 7/19/69 app.
material N/A	title OUTLINE
finish N/A	model no. 130 SERIES dwg no. 130-601 rev A

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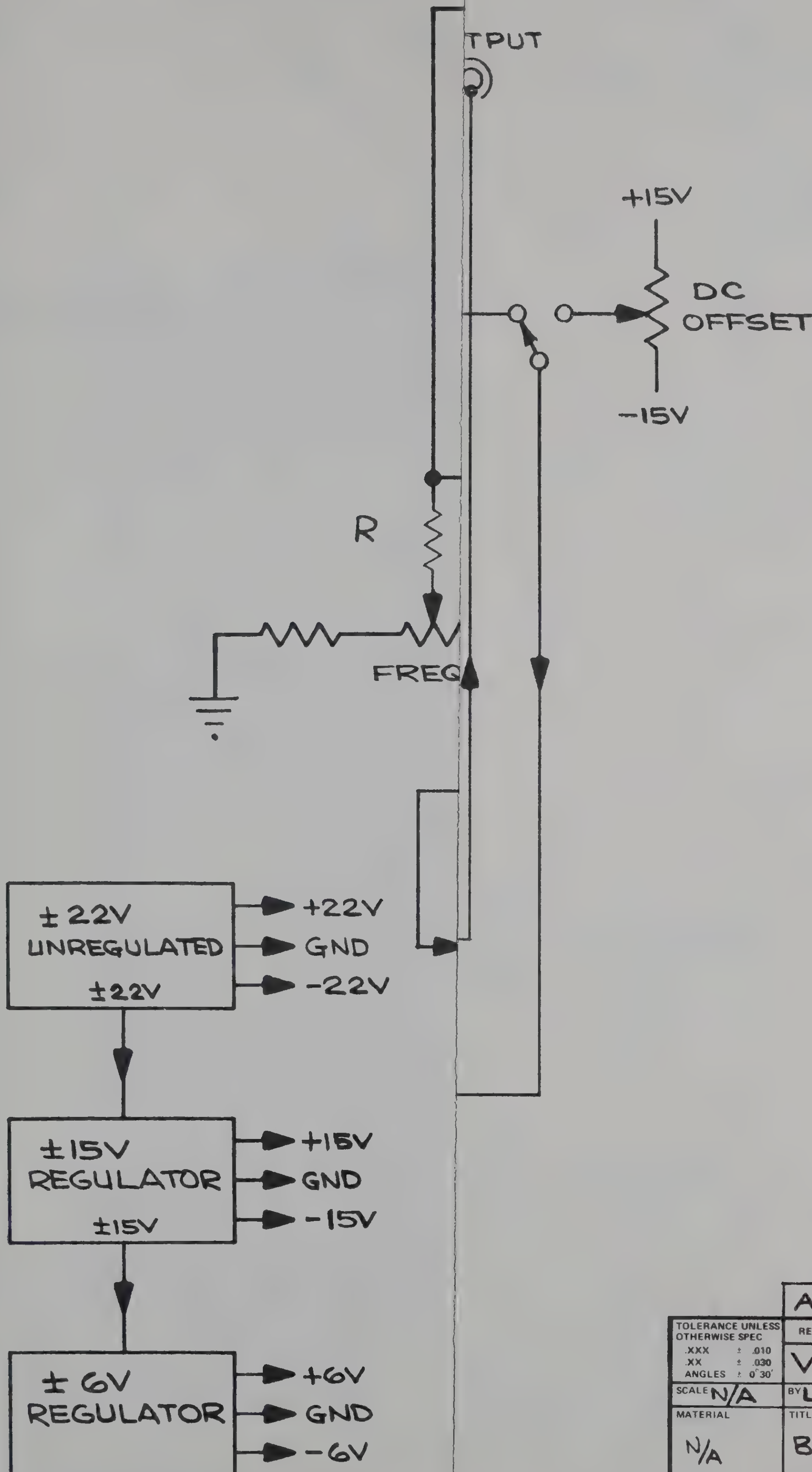

REV	ECN	BY	DATE	APP
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TOLERANCE UNLESS OTHERWISE SPEC
.XXX ± .010
.XX ± .030
ANGLES ± 0°30'

WAVETEK SAN DIEGO, CALIF.

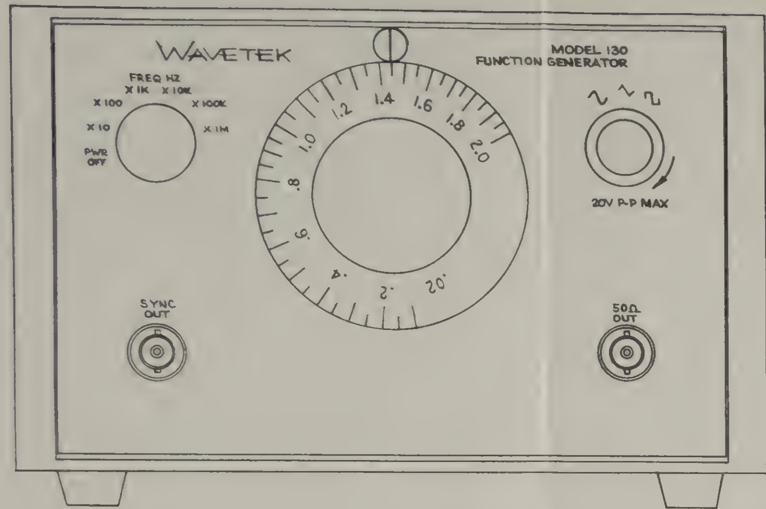
SCALE N/A | BY L D A | DATE 7-23-69 | APP J. O.

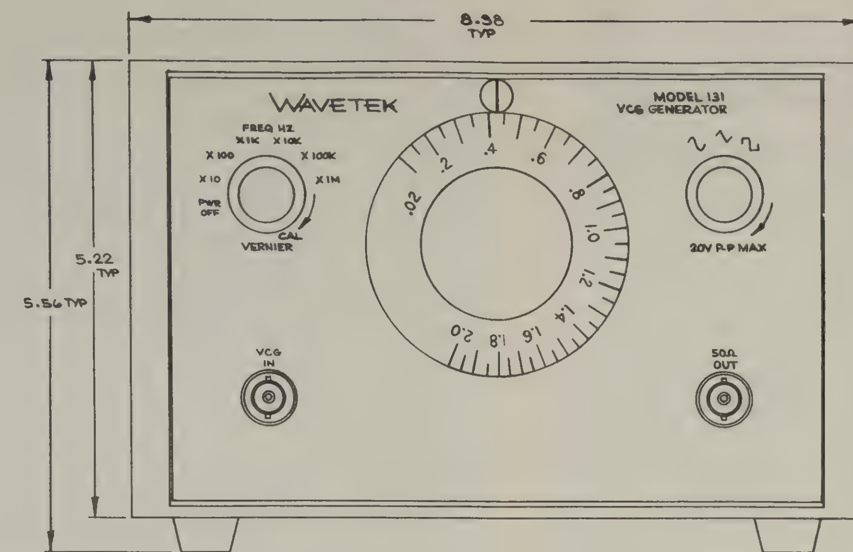
MATERIAL N/A

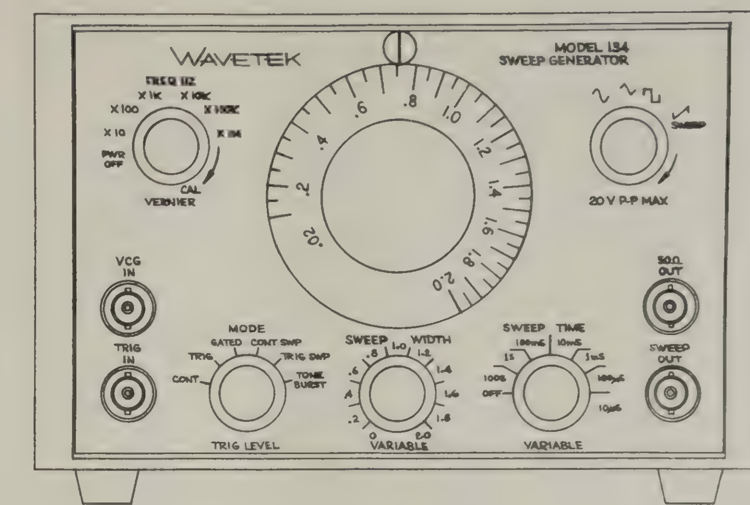
TITLE BLOCK DIAGRAM

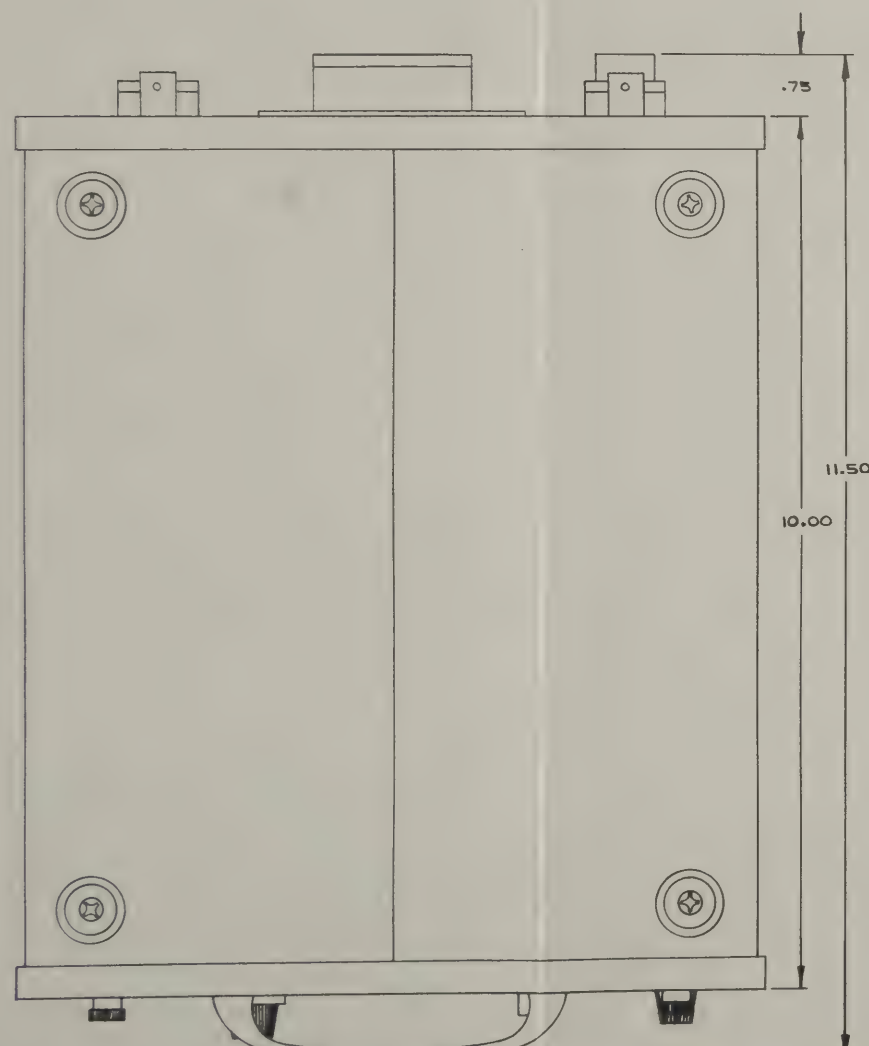
MODEL NO. 130 | DWG NO. 130-600 | REV A

FINISH N/A

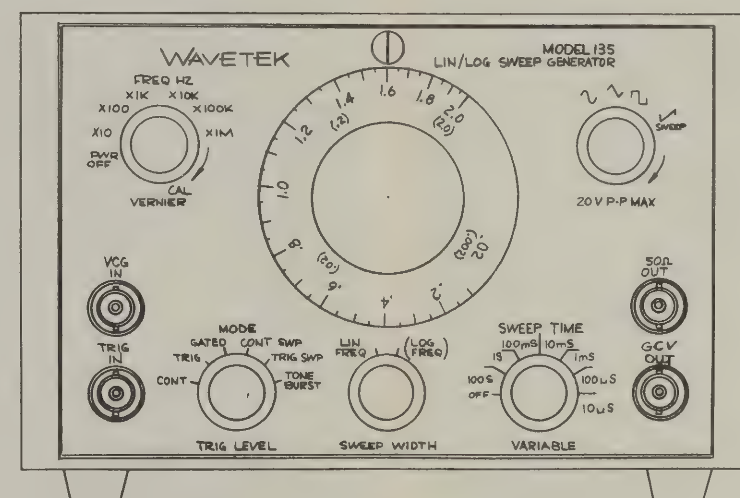


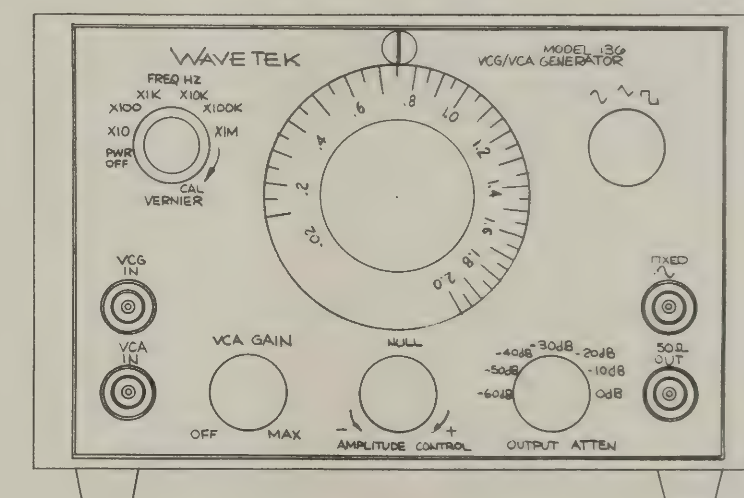


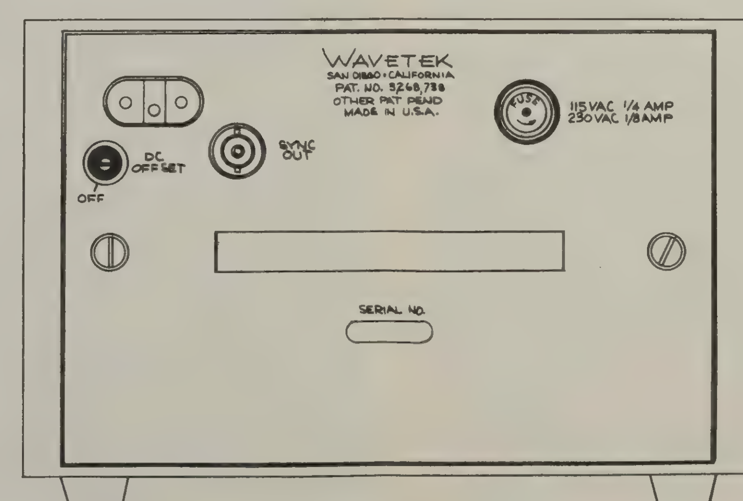




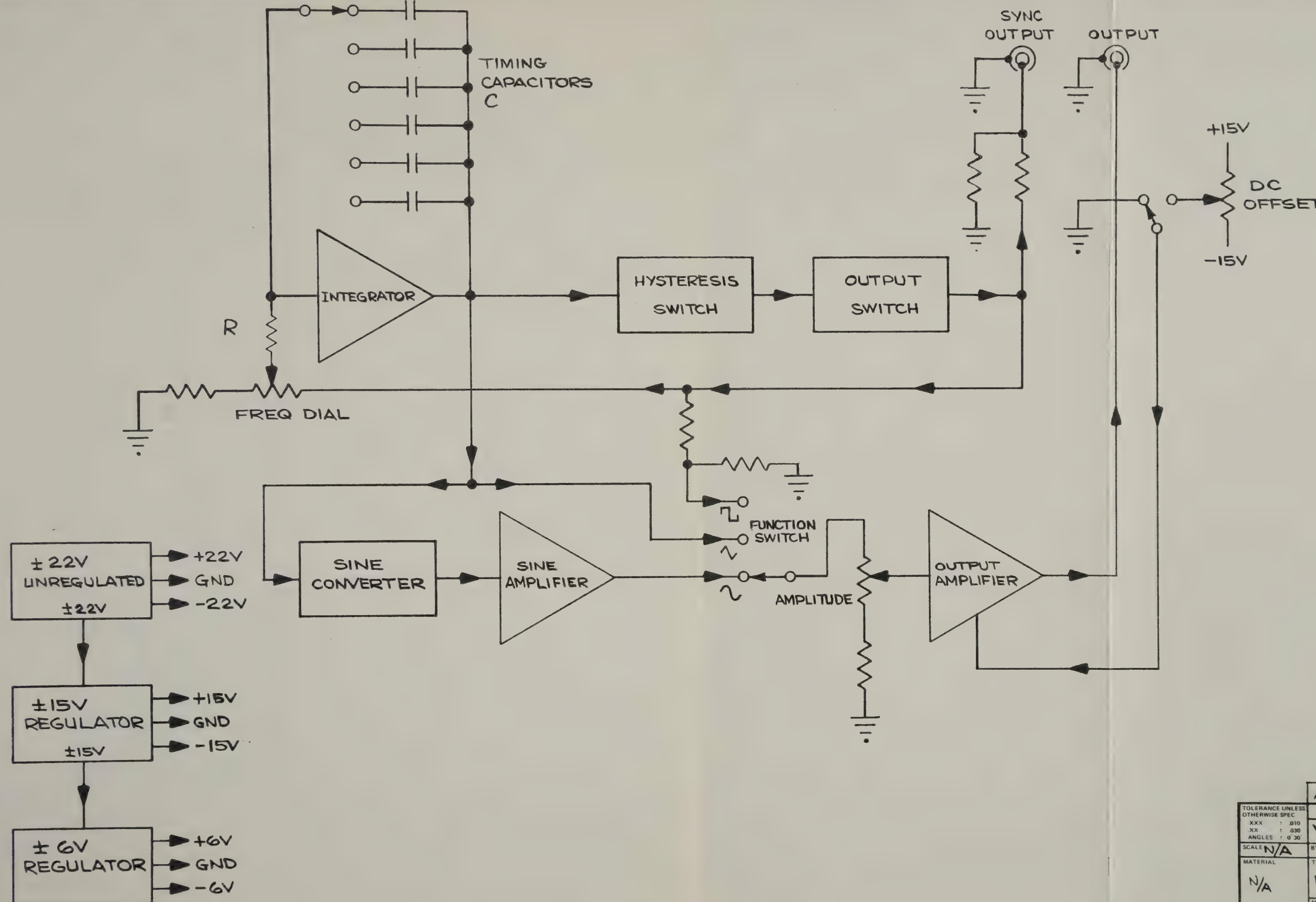
BOTTOM VIEW (TYP)







	A	283	B	11-11-69	
tolerance unless otherwise specified	rev	ecn	by	date	app
.XXX ± .010 .XX ± .030	WAVETEK san diego, calif				
scale FULL	by L. ADAMSON	date 7/19/69	app		
material N/A	title OUTLINE				
finish N/A	model no. 130 SERIES	dwg no. 130-601			rev A



REV	ECN	BY	DATE	APP
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TOLERANCE UNLESS OTHERWISE SPEC
XXX ± .010
.XX ± .030
ANGLES ± 0°30'

WAVETEK SAN DIEGO, CALIF

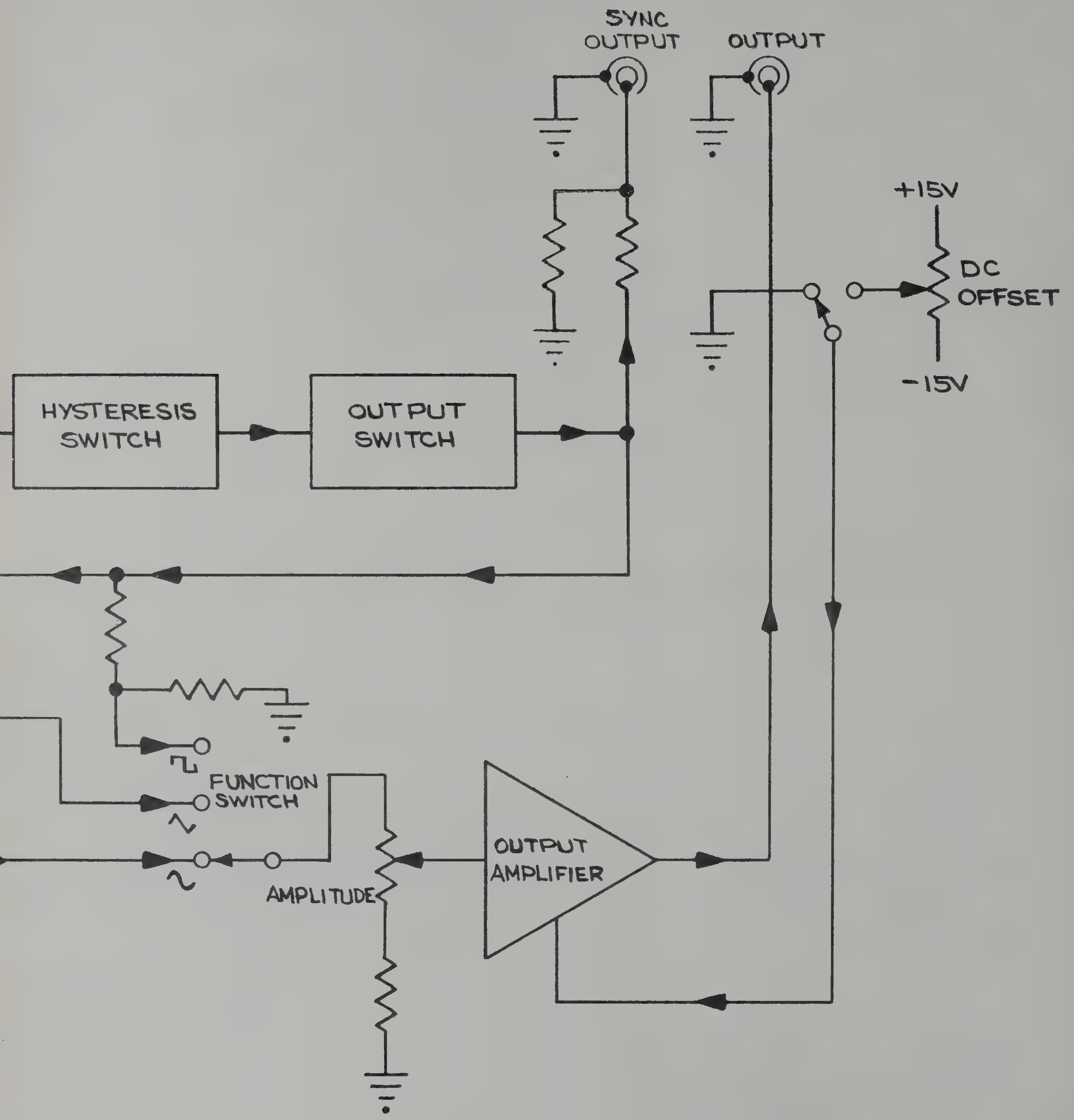
SCALE N/A
BY LDA
DATE 7-23-69
APP J. O.

MATERIAL N/A

TITLE BLOCK DIAGRAM

MODEL NO. 130
DWG NO. 130-600
REV A

FINISH N/A



REV	ECN	BY	DATE	APP
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TOLERANCE UNLESS OTHERWISE SPEC
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.XX ± .030
ANGLES ± 0°30'

SCALE N/A

MATERIAL N/A

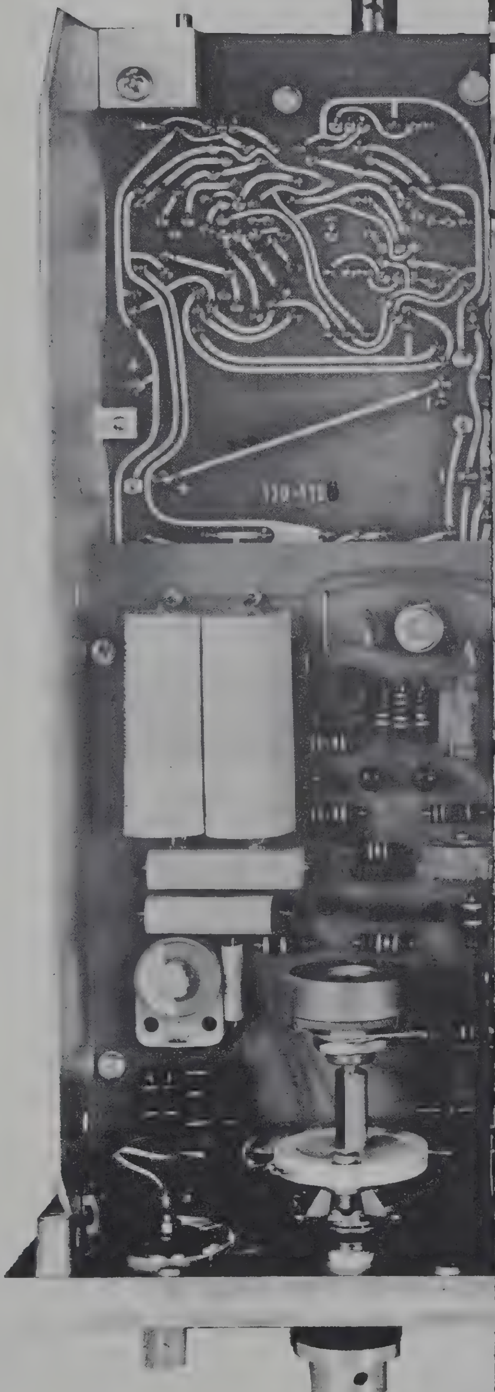
FINISH N/A

WAVETEK SAN DIEGO, CALIF.

BY L.D.A DATE 7/24/69 APP J.O.

TITLE BLOCK DIAGRAM

MODEL NO. 131 DWG NO. 131-600 REV A



	QTY		
MFGR NO	130	131	134
30-010	1	1	1
34-011	–	–	1
134-300	1	1	1
30-301	1	1	1
30-303	1	1	1
30-304	2	2	2
30-305	2	2	2
30-307-1	1	–	–
130-320	1	1	1
30-321	1	2	5
30-322	1	-	-
30-323	1	2	5
34-302-	–	–	1
012-001-2	1	1	1
141-317	1	1	1
5305-31	1	1	1
AIG052P502UA		1	1
30-315	1		
KC7946	2	2	4
7258-5	1	1	1
30-307-2	–	1	–
1162	1	1	1
900-10-8-2	2	2	2
1591B	4	4	8
L210-06-2	4	4	4
4L2FF	2	2	5
2668	6	4	8
1497	3	2	4
F6B	4	4	4
30-313-1	–	1	1
30-313-2	1	–	–

rev	ecn	by	date	app.
A	283	Bo	11/13/69	WR

tolerance unless otherwise specified
.XXX ± .010
.XX ± .030

scale N/A

material N/A

finish N/A

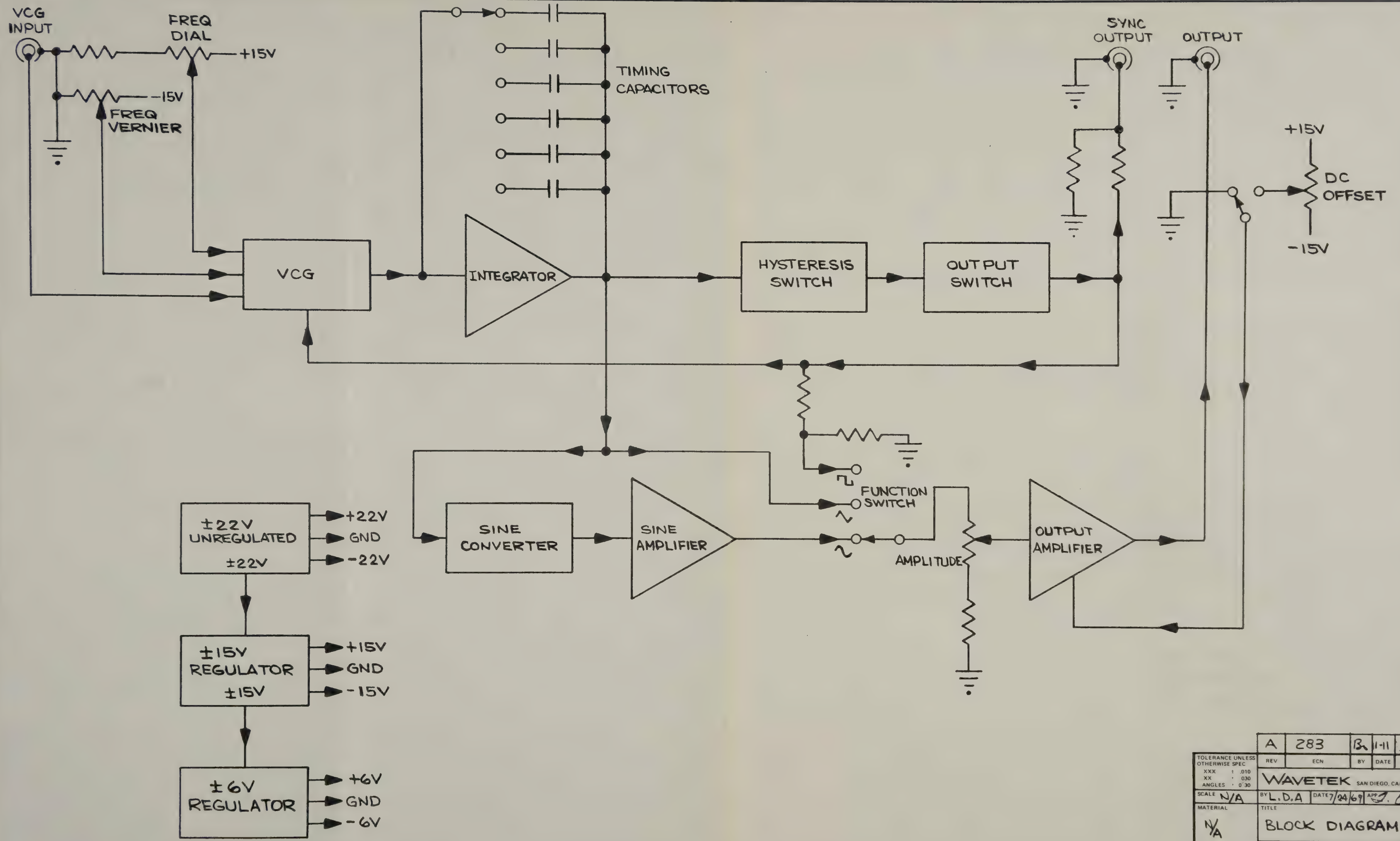
WAVETEK san diego, calif

by BOCHICHIO date 8-1-69 app.

title

CHASSIS ASSY

model no. 130-134 dwg no. 130-000 rev A



REV	ECN	BY	DATE	APP
A	283	Br	1-11	JD

TOLERANCE UNLESS OTHERWISE SPEC
XXX ± .010
XX ± .030
ANGLES ± 0°30

WAVETEK SAN DIEGO, CALIF

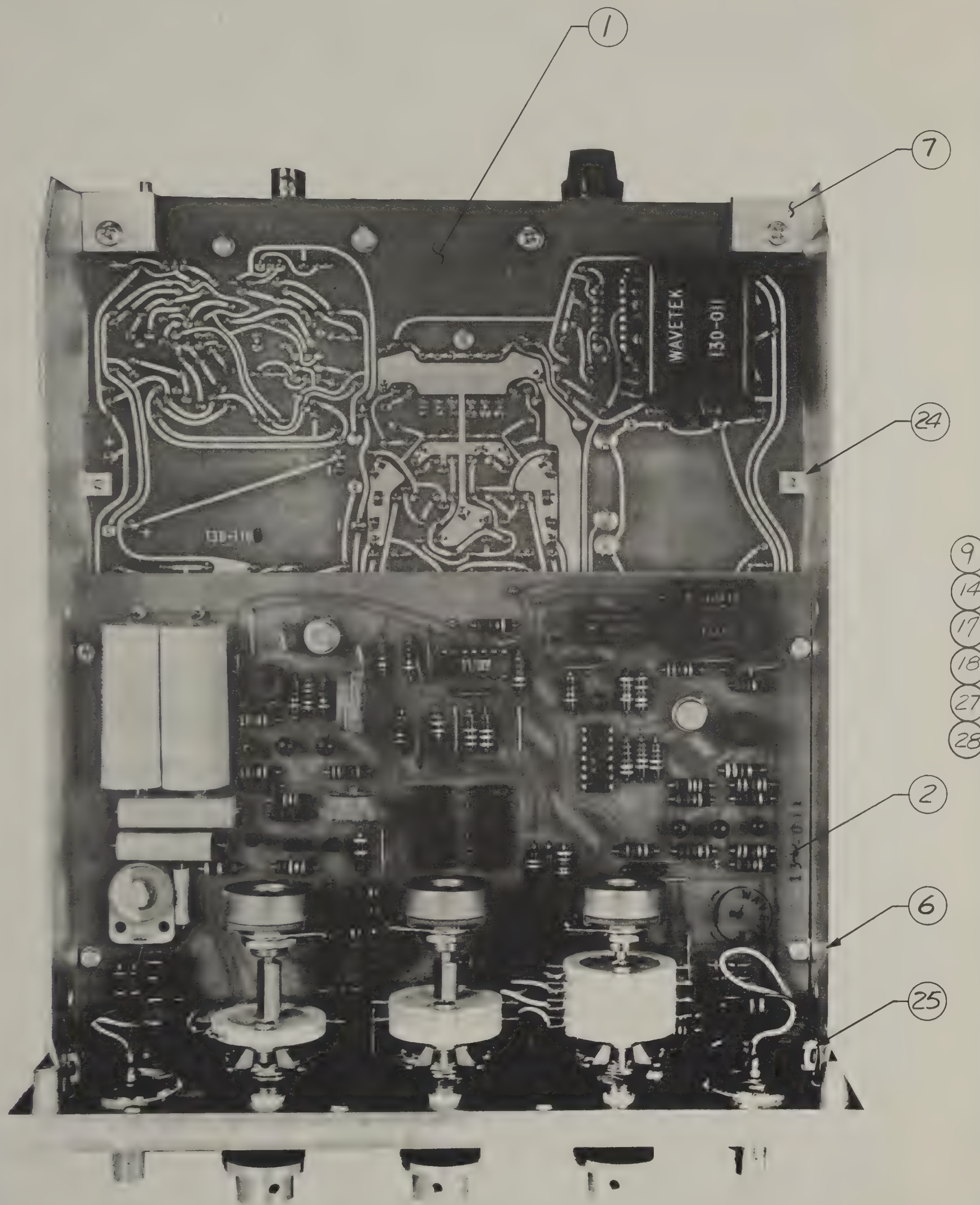
SCALE N/A
BY L.D.A DATE 7/24/69 APP J. O.

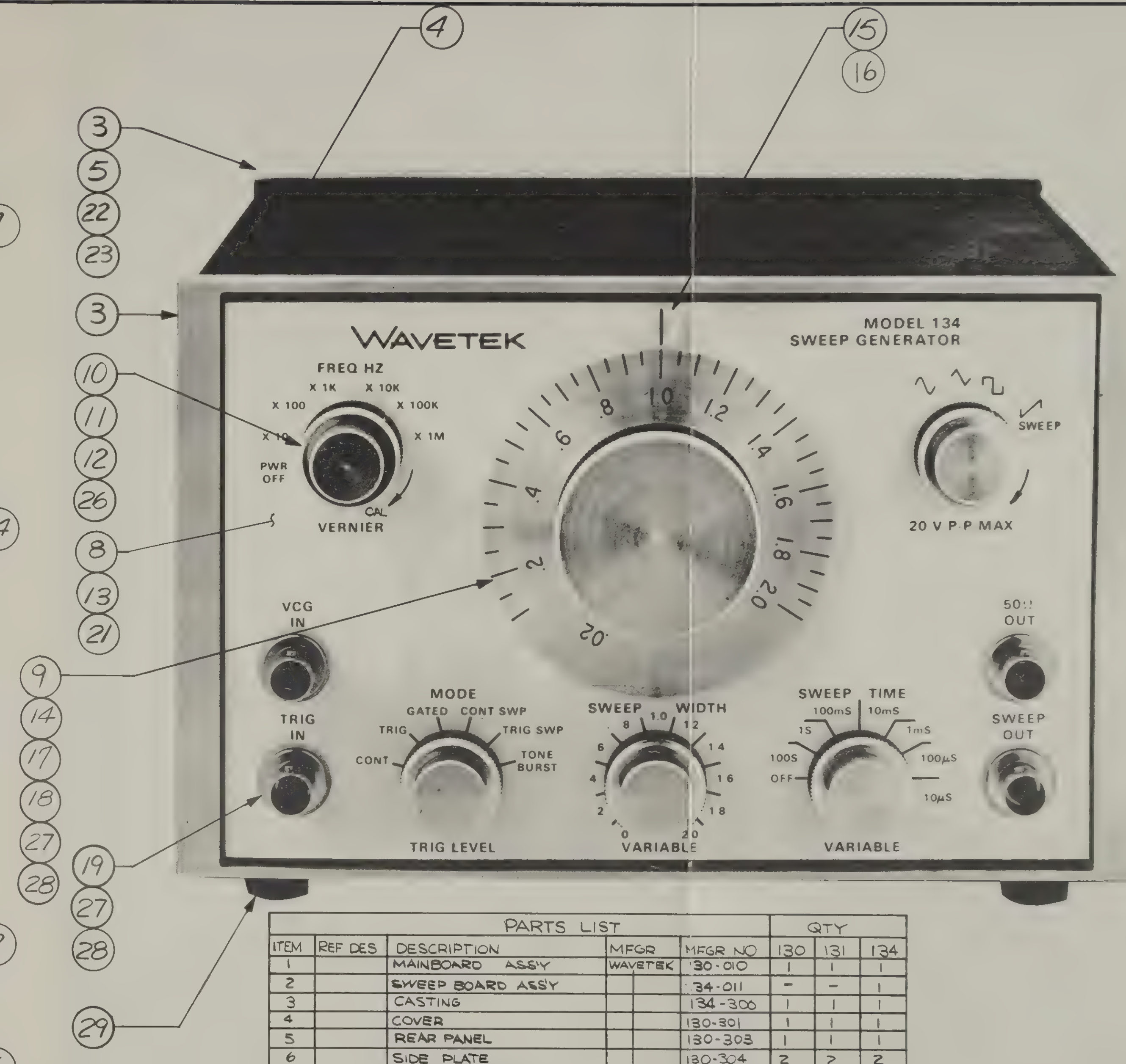
MATERIAL N/A

TITLE
BLOCK DIAGRAM

MODEL NO. 131
DWG NO. 131-600
REV A

FINISH N/A





PARTS LIST					QTY		
ITEM	REF DES	DESCRIPTION	MFGR	MFGR NO	130	131	134
1		MAINBOARD ASS'Y	WAVETEK	130-010	1	1	1
2		SWEEP BOARD ASS'Y		134-011	–	–	1
3		CASTING		134-300	1	1	1
4		COVER		130-301	1	1	1
5		REAR PANEL		130-303	1	1	1
6		SIDE PLATE		130-304	2	2	2
7		MOUNTING BLOCK		130-305	2	2	2
8		FRONT PANEL (130)		130-307-1	1	–	–
9		DIAL KNOB		130-320	1	1	1
10		CO-AXIAL KNOB		130-321	1	2	5
11		STANDARD KNOB		130-322	1	–	–
12		SMALL KNOB		130-323	1	2	5
13		FRONT PANEL (134)		134-302-	–	–	1
14		DIAL		012-001-2	1	1	1
15		INDICATOR LENS		141-317	1	1	1
16		RETAINER	TRUARC	5305-31	1	1	1
17	R1	POT 5K	A/B	JA1G052P502UA		1	1
18	R175	POT, MODIFIED 1K	WAVETEK	130-315	1		
19	J2,J4,J5,J6	BNC CONNECTOR	KING	KC7946	2	2	4
20		POWER CORD	BELDEN	17258-S	1	1	1
21		FRONT PANEL (131)	WAVETEK	130-307-2	–	1	–
22		HANDLE	QUALITY	1162	1	1	1
23		CAPTIVE SCREW	DEUTSCH	7900-10-8-2	2	2	2
24		CHASSIS FASTENER	USECO	1591B	4	4	8
25		CLIP NUT	SHUR-LOK	SL210-06-2	4	4	4
26		BUSHING	THOMPSON	4L2FF	2	2	5
27		SHOULDER WASHER	SMITH	2668	6	4	8
28		SOLDER LUG	SMITH	1497	3	2	4
29		FOOT	BUDWIG	F6B	4	4	4
30							
31		CASTING MODIFICATION	WAVETEK	130-313-1	–	1	1
32		CASTING MODIFICATION	WAVETEK	130-313-2	1	–	–

rev	ecn	by	date	app
A	283	B	11/13/6	[illegible]

tolerance unless otherwise specified .XXX ± .010 .XX ± .030

scale N/A

material N/A

finish N/A

WAVETEK san diego, calif

by BOCHICHIO date 8-1-69 app [illegible]

title

CHASSIS ASSY

model no. 130-134 | dwg no. 130-000 | rev A

MFGR	MFGR NO	130	131	136
ARCO	DM15-560J	1	1	1
	680J	1	1	1
	151J	2	2	2
	301J	2	2	2
	561J	2	2	2
	911F	1	1	1
CRL	DD-100	1	2	2
	DD-220	4	4	4
	DD-330	2	2	2
	DD-470	2	2	2
	DD-151	2	2	1
	DD-471	1	1	-
	DD-681	2	2	2
	DD-221	2	4	4
	CK-502	2	4	4
	CK-103	2	2	-
	UK20-104	2	6	6
IMB	PA28103F	1	1	1
	PA28104F	1	1	1
ELECTRO CUBE	210-B1C-105F	1	1	1
AMERICAN RADIONIC	WYTK-2MFW	2	2	2
SPRAGUE	500D107G016DC7	6	6	6
	39D108G035GL4	2	2	2
ERIE	503-001-37A	3	3	2
FAIRCHILD	FD6666	2	4	11
SEMTECH	SCE-1	4	4	4
TEXAS INST	TIP29	1	1	1
	TIP30	1	1	1
FAIRCHILD	2N2905	2	2	1
	2N3299	2	2	1
MOTOROLA	MPS 3640	3	3	3
FAIRCHILD	2N3646	8	8	6
	2N3638	3	3	3
	2N3638	3	3	3
MOTOROLA	2N3903	1	1	1
	2N3905	1	1	1
SPRAGUE	TD101	1	1	-
FAIRCHILD	2N2905	2	2	-
MOTOROLA	MPS 3640	2	2	2
FAIRCHILD	2N3646	4	4	4
	2N3638	2	2	2

ON CIRCUIT SIDE

" " "

*S

NOMINAL VALUE

PARTS LIST

ITEM	REF DES	DESCRIPTION		MFGR	MFGR NO	130	131	136
63	IC1, 3,	LINEAR IC	(-13)	FAIRCHILD	µA709C	0	2	2
64	IC5.		(-15)	RCA	CA3030	1	1	1
65	IC4		(-17)		CA3036	1	1	1
66	IC2		(-18)		CA3039	-	1	1
67	IC6, IC7		(-14)	FAIRCHILD	µA709C	2	2	2
68	IC8		(-16)	RCA	CA-3030	1	1	1
69								
70								
71								
72	R56, R59	POTENTIOMETER	100Ω	CRL	BA1603-801	2	2	2
73	R126, R127		250Ω		-021	2	2	2
74	R4, R173 R121, R133		500Ω		-802	3	3	3
75	R135		1K	CTS	IN 130-SW2 ASSY	1	1	1
76	R104		1K	CRL	BA1603-803	1	1	1
77	R8 R11 R22 R28 R128, R150		100K		-819	3	6	5
78	R10		10K	CTS	130-R1A	-	1	1
79							-	
80								
81								
82								
83	R38, R39 R162, R163	CARBON, 1/2W, 5%	4.7Ω	STACKPOLE	RC20GF4R7K	4	4	2
84	R90, R95 R136, R176†		6.8Ω		6R8K	4	3	2
85	R86, R87		10Ω		100K	2	2	2
86	R138		27Ω		270K	1	1	-
87	R17, R26, R37 R40, R169		47Ω		470K	3	5	4
88								
89	R57 R58 R79 R80		100Ω		101K	4	4	4
90	R116, R117	10%	330Ω		331K	2	2	2
91	R52, R63	5%	390Ω		391K	2	2	2
92	R65, R71 R91, R94	10%	470Ω		471K	4	4	4
93	R32 R33 R132 R134		560Ω		561K	4	4	4
94	R16		680Ω		681K	-	1	1
95	R30 R75, R76 R160		1K		102K	4	4	3
96	R177	5%	2K		202J	1	-	-
97	R15 R25 R98 R99	10%	1.5K		152K	2	4	4
98	R34-R36, R180		2.2K		222K	4	4	4
99	R24, R112, R113 R73		2.7K		272K	3	4	4
100	R13 R101		3.9K		392K	1	2	2
101	R88 R89 R92 R93 R96, R97, R107		4.7K		472K	7	7	7
102	R53, R62	5%	6.2K		622J	2	2	2
103								
104	R178	10%	10K		103K	1	1	1
105								
106	R114, R115	10%	18K		183K	2	2	2
107	R31, R54, R61		27K		273K	3	3	3
108	R20		91K		913J	-	1	1
109							-	
110	R6		220K		224K	-	1	1
111	R146		270K		274K	1	1	-
112	R143		560K		564K	1	1	-
113	R29		820K		824K	1	1	1
114	R129		1MΩ		105K	1	1	1
115	R94	5%	1M		105J	-	1	1
116								
117	R7, R23	10%	3.9MΩ		395K	-	2	2
118	R12		4.7MΩ		475K	-	1	1
119	R184		6.8MΩ		685	-	1	1
120	R182	5%	750Ω		751J	1	1	1
121								
122								
123	R161, R164	CARBON, 2W 10%	47Ω	STACKPOLE	RC42GF470K	2	2	-
124	R159	METAL FILM, 1W, 1%	1K	IRC	MEC RN70D	1	1	-
125								
126		MATCHED RESISTORS						
127	R109, R110	METALFILM 1/4W 1%	2.49K (-1)	CORNING	RN60D	2	2	2
128	R118, R119		4.02K (-2)			2	2	2
129	R103, R106 R108, R111		10K (-4)			4	4	4

PARTS LIST

ITEM	REF DES	DESCRIPTION		MFGR	MFGR NO	130	131	136
130	R139, R140	METALFILM, 1/4W, 1%, 21.5Ω		CORNING	RN60D	2	2	-
131	R155-R158		10Ω			4	4	-
132	R2‡		46.4Ω			-	1	1
133	R51, R165 R166, R167 R168		49.9Ω			5	5	2
134	R154		61.9Ω			1	1	-
135	R81 R123		82.5Ω			2	2	2
136	R124		150Ω			1	1	1
137	R74 R78 R141, R151		249Ω			4	4	2
138	R55, R60 R137 R142		499Ω			4	4	2
139								
140	R72 R77		909Ω			2	2	2
141	R84		316Ω			1	1	1
142	R85		124Ω			1	1	1
143	R130		1K			1	1	1
144	R145, R153		1.78K			2	2	-
145	R100		2.87K			1	1	1
146	R64, R70		3.01K			2	2	2
147	R120, R122		3.83K			2	2	2
148	R174		4.32K			1	-	-
149	R66, R69		4.75K			2	2	2
150	R3, R144,		4.99K			1	2	1
151	R14, R21, R18 R19, R27, R181	(MATCHED) SET	6.19K (-3)			-	6	6
152	R67, R68, R105		6.98K			3	3	3
153	R102, R131		8.25K			2	2	2
154	R152		8.87K			1	1	-
155	R5		15K			-	1	1
156	R183		619K				1	1
157								
158	SW1-C, -D	WAFER		CTS	130-SW1-3	2	2	2
159								
160	SW1	DETENT		WAVETEK	130-SW1	1	1	1
161	SW1-A	WAFER		CTS	T106	1	1	1
162	SW1-B			WAVETEK	130-SW1-2	1	1	1
163	SW3	SWITCH			130-SW2	1	1	1
164								
165								
166		TRANSISTOR HEATSINK		WAKEFIELD	NF-207	2	2	-
167		TRANSIPAD		M. ROSS	10123N	3	3	3
168					10160	2	2	2
169	A, A*	AMP PIN		AMP	61182-2	9	11	16
170	T, T*	TERMINALS		USECO	2010B-1	3	3	3
171	TT				2000B-1	6	6	6
172		SOLDER LUG		SMITH	1497	1	1	1
173								
174	A1	SINE MODULE		WAVETEK	130-011	1	1	1
175		BRACKET ASSY			130-001	1	1	1
176		HEATSINK			130-311	1	1	1
177	I1	LAMP		MURA	L28/40	1	1	1
178		CIRCUIT BD (DRILL 130-510)		WAVETEK	130-110F	1	1	1
179								
180								
181		SUPPORT BLOCK		WAVETEK	130-328	1	1	1
182		TRANSFORMER BRACKET			130-306			
183								
184								
185								

rev	ecn	by	date	app
C	ECN 300	NG	8/9/70	
B	ECN 300	NG	3-8-70	
A	283	Bo	11-11-69	WD

tolerance unless otherwise specified .XXX ± .010 .XX ± .030

WAVETEK san diego, calif

by BOCHICHIO date 7-24-69 app

scale N/A

material N/A

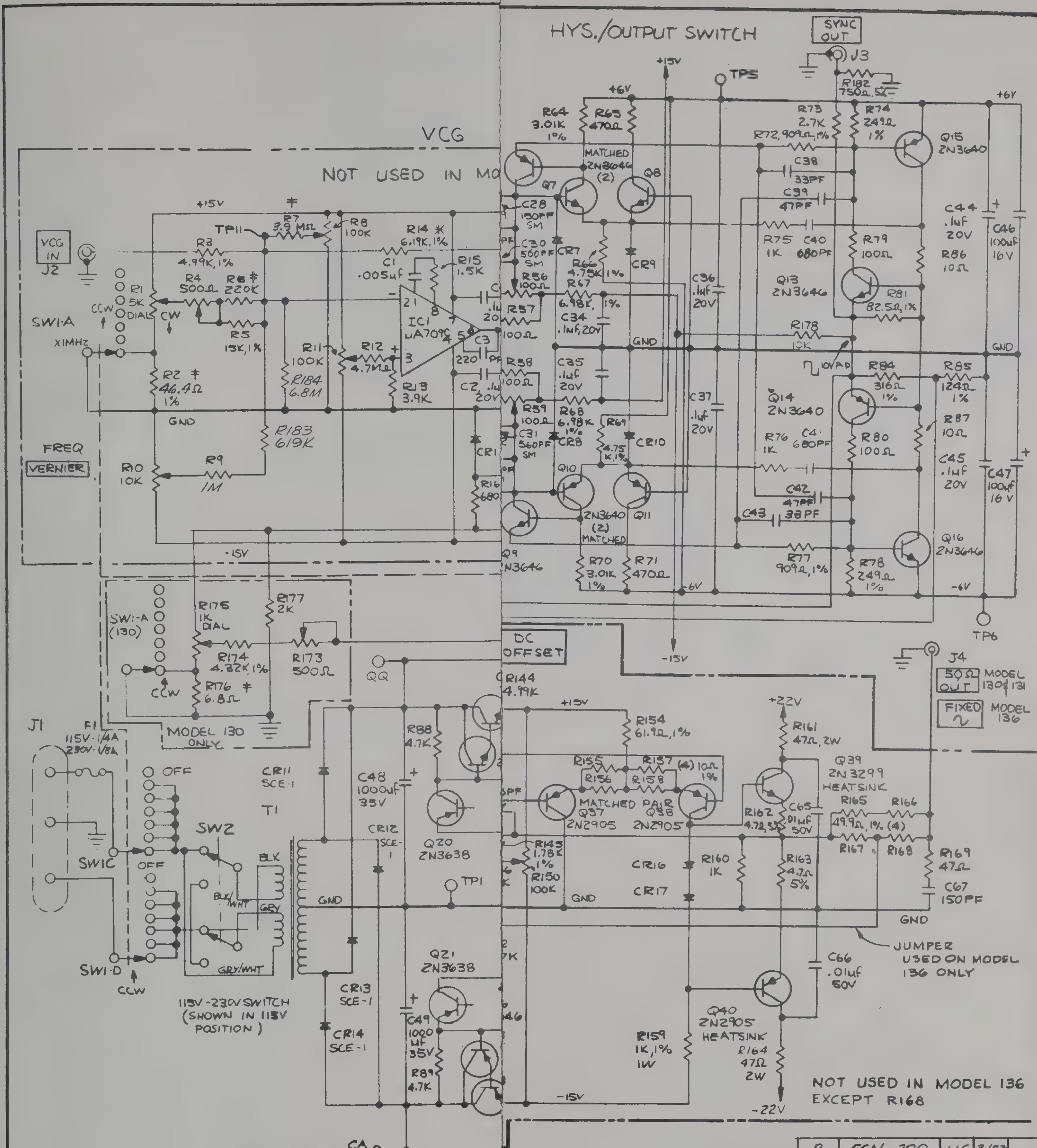
finish N/A

title ASS'Y MAIN BD

model no 130, 131, 136

dwg no 130-010 131-010 136-010

re. C



NOTES UNLESS OTHERWISE SPECIFIED

1. * INDICATES MATCHED SET (R14, R18, R19, R21, R181, R27), (R118, R119), (R109, R110), (R103, R111), (R106, R108)
2. DIODES ARE FD6666
3. RESISTORS ARE CARBON, 1/2W.
4. *C17, C18, C19, C20, C54 ARE A MATCHED SET
5. IC2: CA3039
6. IC2, IC4 & IC5 ARE SELECTED
7. ‡ INDICATES SELECTED VALUE; NOMINAL VALUE AS SHOWN

FREQ COMP (INPUT) — 1
— 2
INPUT + 3

DESIGNATOR USED

rev	ecn	by	date	app
B	ECN 300	NG	3-18-70	
A	REFER NO. 283	WM	31 OCT 69	WD

tolerance unless otherwise specified: XXX ± .010, XX ± .030

WAVETEK san diego, calif

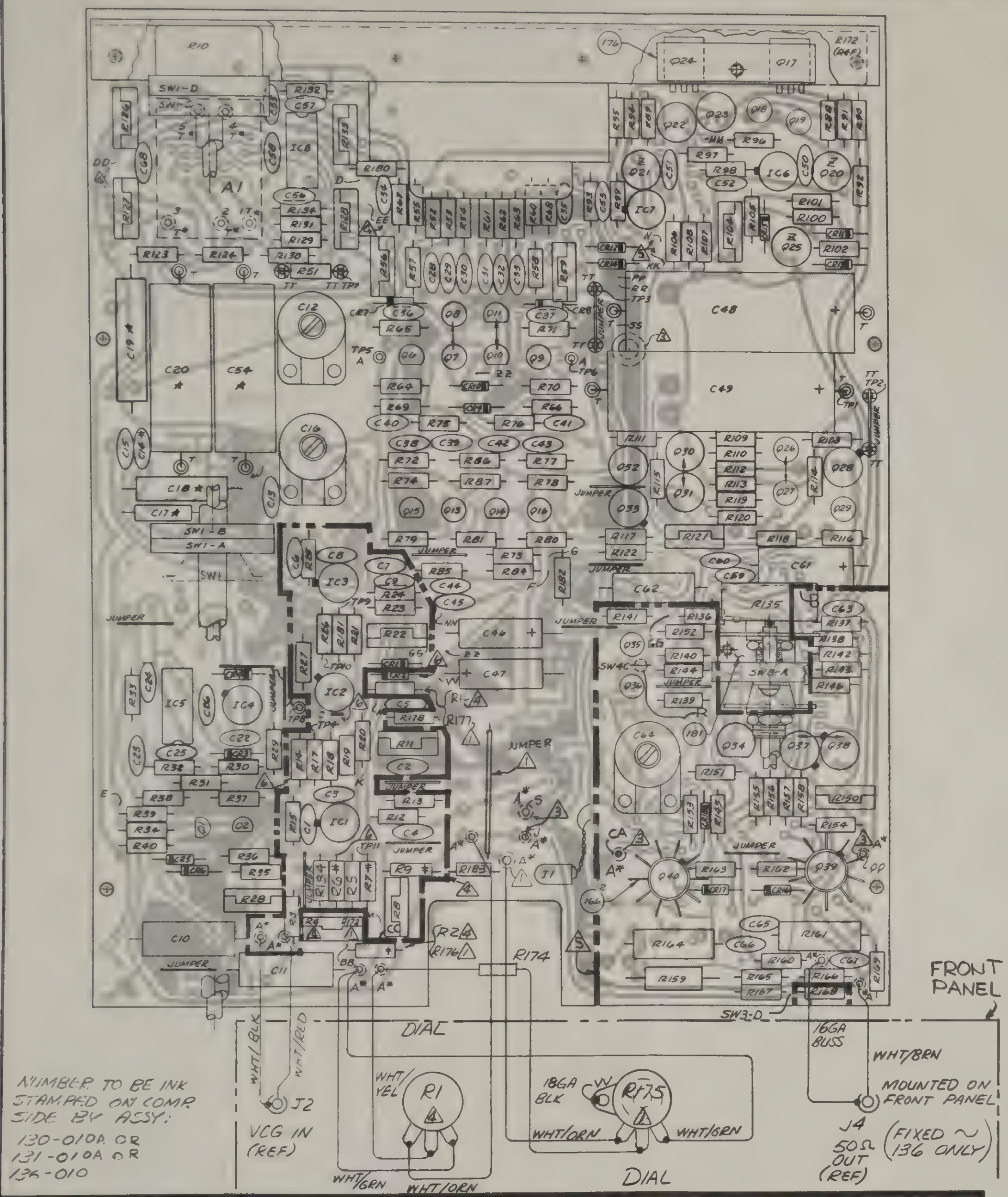
scale N/A | by N. BOCHICCHIO | date 7-19-69 | app J. Ofayo

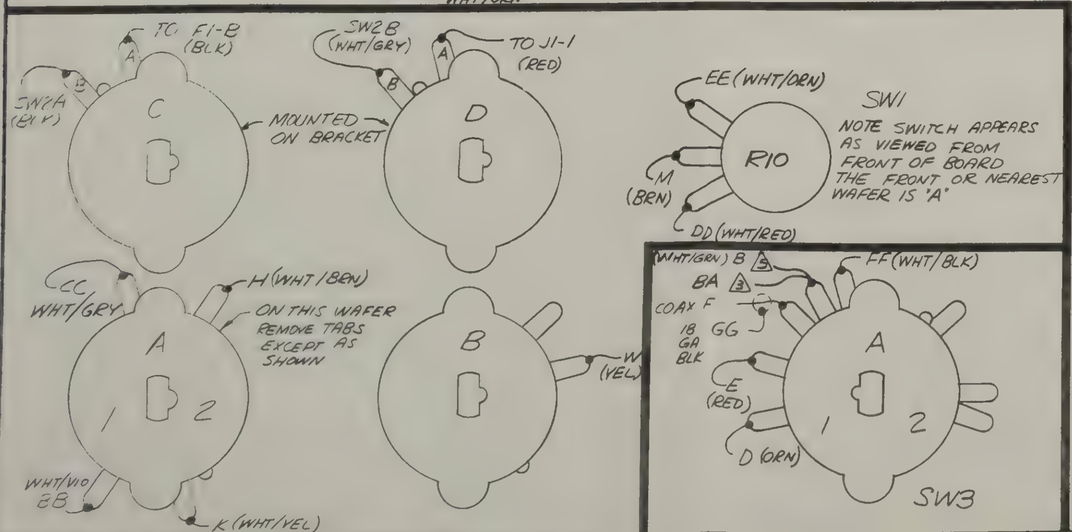
material N/A

title SCHEMATIC - MAIN BD

model no. 130, 131, 136 | dwg no 130-210, 131-210, 136-210 | rev B

finish N/A





PARTS LIST

ITEM	REF DES	DESCRIPTION	MFGR	MFGR NO	QTY 130	QTY 131	QTY 136
1	C14‡	SILVER MICA, 500V, 5%, 56PF	ARCO	DM15-560J	1	1	1
2	C13	68PF		680J	1	1	1
3	C28, C33	150PF		151J	2	2	2
4	C29, C32	300PF		301J	2	2	2
5	C30, C31	560PF		561J	2	2	2
6	C15	1%, 910PF		911F	1	1	1
7	C5, C22	CERAMIC DISC, 1000V 10PF	CRL	DD-100	1	2	2
8	C55, C56, C23, C24	22PF		DD-220	4	4	4
9	C38, C43	33PF		DD-330	2	2	2
10	C39, C42	47PF		DD-470	2	2	2
11							
12	C67, C68	150PF		DD-151	2	2	1
13	C63	470PF		DD-471	1	1	-
14	C40, C41	680PF		DD-681	2	2	2
15	C3, C8, C50, C51	220PF		DD-221	2	4	4
16	C1, C6, C52, C53	50V .005uF		CK-502	2	4	4
17	C65, C66	50V .01uF		CK-103	2	2	-
18	C2, C4, C7, C9, C25, C26, C34-C37, C44, C45, C57, C58, C59, C60	20V .1uF		UK20-104	12	16	16
19	C17	POLY, 100V, 1%, .01uF	IMB	PA2B103F	1	1	1
20	C18	.1uF		PA2B104F	1	1	1
21	C19	MYLAR, 200V 1uF (-6)	ELECTRO CUBE	210-B1C-105F	1	1	1
22	C20, C54	M. MYLAR 10%, 5uF	AMERICAN RADIONIC	WVTK-2MFW	2	2	2
23	C10, C11, C46, C47, C61, C62	ELECTROLYTIC, 16V, 100uF	SPRAGUE	500D107G016DC7	6	6	6
24	C48, C49	35V 1000uF		39D108G035SL4	2	2	2
25	C12, C16, C64	VARIABLE 4.5-25PF	ERIE	503-001-37A	3	3	2
26							
27							
28							
29							
30							
31	CR1-CR10, CR15-CR18	DIODE FD6666	FAIRCHILD	FD6666	12	14	11
32	CR11-CR14	SCE-1	SEMTECH	SCE-1	4	4	4
33							
34							
35							
36							
37							
38	Q17	MODIFIED PER 130-316	TEXAS INST	TIP29	1	1	1
39	Q24	MODIFIED PER 130-316		TIP30	1	1	1
40	Q33, Q40	2N2905	FAIRCHILD	2N2905	2	2	1
41	Q28, Q39	2N3299		2N3299	2	2	1
42							
43	Q6, Q14, Q15	MPS 3640	MOTOROLA	MPS 3640	3	3	3
44	Q9, Q13, Q16, Q18, Q19, Q29, Q35, Q36	2N3646	FAIRCHILD	2N3646	8	8	6
45	Q22, Q23, Q32	2N3638		2N3638	3	3	3
46	Q20, Q21, Q25	(ZENER) 2N3638 (-12)		2N3638	3	3	3
47	Q1	2N3903	MOTOROLA	2N3903	1	1	1
48	Q2	2N3905		2N3905	1	1	1
49	Q34	TD101	SPRAGUE	TD101	1	1	-
50	Q37, Q38	MATCHED 2N2905 (-8)	FAIRCHILD	2N2905	2	2	4
51	Q10, Q11	MPS3640 (-10)	MOTOROLA	MPS 3640	2	2	2
52	Q7, Q8, Q26, Q27	2N3646 (-11)	FAIRCHILD	2N3646	4	4	4
53	Q30, Q31	2N3638 (-9)		2N3638	2	2	2
54							
55							
60							
61							
62							

1. MODEL 130 ONLY
2. MODEL 131 ONLY
3. MODEL 136 ONLY
4. MODEL 131 & 136 ONLY
5. MODEL 130 & 131 ONLY
6. JUMPER FOR MODEL 130 ONLY
7.
8. A* INDICATES AMP PIN INSTALLED ON CIRCUIT SIDE
9. T* " TERMINAL " " " "
10. ★ INDICATES MATCHED SET
11. ← INDICATES MATCHED PAIRS
12. Z INDICATES ZENER
13. ‡ INDICATES SELECTED VALUE NOMINAL VALUE AS SHOWN

PARTS LIST

ITEM	REF DES	DESCRIPTION	MFGR	MFGR NO	QTY 130	QTY 131	QTY 136
63	IC1, IC3	LINEAR IC (-13)	FAIRCHILD	uA709C	2	2	2
64	IC5	(-15)	RCA	CA3030	1	1	1
65	IC4	(-17)		CA3036	1	1	1
66	IC2	(-18)		CA3039	1	1	1
67	IC6, IC7	(-14)	FAIRCHILD	uA709C	2	2	2
68	IC8	(-16)	RCA	CA-3030	1	1	1
69							
70							
71							
72	R56, R59	POTENTIOMETER 100Ω	CRL	BA1603-801	2	2	2
73	R126, R127	250Ω		-021	2	2	2
74	R4, R173, R21, R133	500Ω		-802	3	3	3
75	R135	1K	CTS	IN 130-SW2 ASSY	1	1	1
76	R104	1K	CRL	BA1603-803	1	1	1
77	R8, R11, R22, R28, R128, R150	100K		-819	3	6	5
78	R10	10K	CTS	130-R1A	-	1	1
79							
80							
81							
82							
83	R38, R39, R162, R163	CARBON, 1/2W, 5% 4.7Ω	STACKPOLE	RC20GF4R7K	4	4	2
84	R90, R95, R136, R176	6.8Ω		6R8K	4	3	2
85	R86, R87	10Ω		100K	2	2	2
86	R138	27Ω		270K	1	1	-
87	R17, R26, R37, R40, R169	47Ω		470K	3	5	4
88							
89	R57, R58, R79, R80	100Ω		101K	4	4	4
90	R116, R117	10% 330Ω		331K	2	2	2
91	R52, R63	5% 390Ω		391K	2	2	2
92	R65, R71, R91, R94	10% 470Ω		471K	4	4	4
93	R32, R33, R132, R134	560Ω		561K	4	4	4
94	R16	680Ω		681K	-	1	1
95	R30, R75, R76, R160	1K		102K	4	4	3
96	R177	5% 2K		202J	1	-	-
97	R15, R26, R98, R99	10% 1.5K		152K	2	4	4
98	R34-R36, R180	2.2K		222K	4	4	4
99	R24, R112, R113, R73	2.7K		272K	3	4	4
100	R13, R101	3.9K		392K	1	2	2
101	R88, R89, R92, R93, R96, R97, R107	4.7K		472K	7	7	7
102	R53, R62	5% 6.2K		622J	2	2	2
103							
104	R178	10% 10K		103K	1	1	1
105							
106	R114, R115	10% 18K		183K	2	2	2
107	R31, R54, R61	27K		273K	3	3	3
108	R20	91K		913J	-	1	1
109							
110	R6	220K		224K	-	1	1
111	R146	270K		274K	1	1	-
112	R143	560K		564K	1	1	-
113	R29	820K		824K	1	1	-
114	R129	1MΩ		105K	1	1	1
115	R94	5% 1M		105J	-	1	1
116							
117	R7, R23	10% 3.9MΩ		395K	-	2	2
118	R12	4.7MΩ		475K	-	1	1
119	R184	6.8MΩ		685	-	1	1
120	R182	5% 750Ω		751J	1	1	1
121							
122							
123	R161, R164	CARBON, 2W 10% 47Ω	STACKPOLE	RC42GF470K	2	2	-
124	R159	METAL FILM 1W, 1% 1K	IRC	MEC RN70D	1	1	-
125							
126		MATCHED RESISTORS					
127	R109, R110	METAL FILM 1/4W 1% 2.49K (-1)	CORNING	RN60D	2	2	2
128	R118, R119	4.02K (-2)			2	2	2
129	R103, R106, R108, R111	10K (-4)			4	4	4

PARTS LIST

ITEM	REF DES	DESCRIPTION	MFGR	MFGR NO	QTY 130	QTY 131	QTY 136
130	R139, R140	METALFILM, 1/4W, 1%, 21.5Ω	CORNING	RN60D	2	2	[illegible]
131	R155-R158	10Ω			4	4	[illegible]
132	R2‡	46.4Ω			-	1	[illegible]
133	R51, R165, R166, R167, R168	49.9Ω			5	5	2
134	R154	61.9Ω			1	1	-
135	R81, R123	82.5Ω			2	2	2
136	R124	150Ω			1	1	1
137	R74, R78, R141, R151	249Ω			4	4	2
138	R55, R60, R137, R142	499Ω			4	4	2
139							
140	R72, R77	909Ω			2	2	2
141	R84	316Ω			1		[illegible]
142	R85	124Ω			1	1	[illegible]
143	R130	1K			1	1	1
144	R145, R153	1.78K			2	2	-
145	R100	2.87K			1	1	1
146	R64, R70	3.01K			2	2	2
147	R120, R122	3.83K			2	2	2
148	R174	4.32K			1	-	[illegible]
149	R66, R69	4.75K			2	2	2
150	R3, R144	4.99K			1	2	1
151	R14, R21, R18, R19, R27, R181	(MATCHED SET) 6.19K (-3)			-	6	[illegible]
152	R67, R68, R105	6.98K			3	3	3
153	R102, R131	8.25K			2	2	2
154	R152	8.87K			1	1	-
155	R5	15K			-	1	1
156	R183	619K				1	1
157							
158	SW1-C, -D	WAFER	CTS	130-SW1-3	2	2	2
159							
160	SW1	DETENT	WAVETEK	130-SW1	1	1	1
161	SW1-A	WAFER	CTS	T106	1	1	1
162	SW1-B		WAVETEK	130-SW1-2	1	1	1
163	SW3	SWITCH		130-SW2	1	1	1
164							
165							
166		TRANSISTOR HEATSINK	WAKEFIELD	NF-207	2	2	-
167		TRANSIPAD	M. ROSS	10123N	1/3	1/3	1/3
168				10160	2	2	2
169	A, A*	AMP PIN	AMP	61182-2	[illegible]	[illegible]	[illegible]
170	T, T*	TERMINALS	USECO	2010B-1	13	13	13
171	TT			2000B-1	6	6	6
172		SOLDER LUG	SMITH	1497	1	1	1
173							
174	A1	SINE MODULE	WAVETEK	130-011	1	1	1
175		BRACKET ASSY		130-001	1	1	1
176		HEATSINK		130-311	1	1	1
177	I1	LAMP	MURA	L28/40		1	1
178		CIRCUIT BD (DRILL 130-510)	WAVETEK	130-110F	1	1	1
179							
180							
181		SUPPORT BLOCK	WAVETEK	130-328	1	1	1
182		TRANSFORMER BRACKET		130-306			
183							
184							
185							

rev	ecn	by	date	app
C	ECN 300	NG	8/19/70	
B	ECN 300	NG	3-8-70	
A	283	B.	11-11-69	WD

tolerance unless otherwise specified XXX ± .010 XX ± .030

WAVETEK san diego, calif

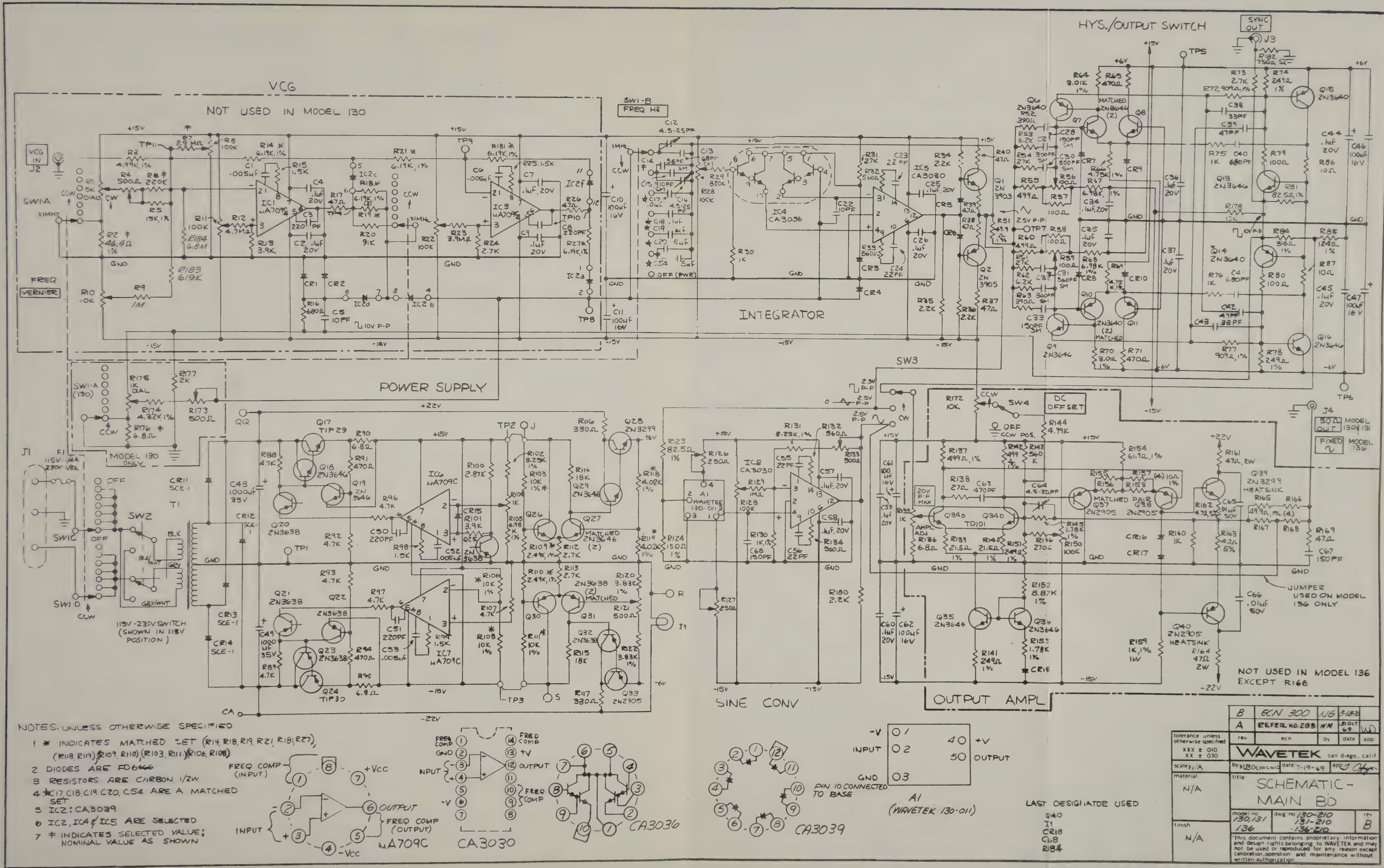
scale N/A | by BOCHICHIO | date 7-24-69 | app

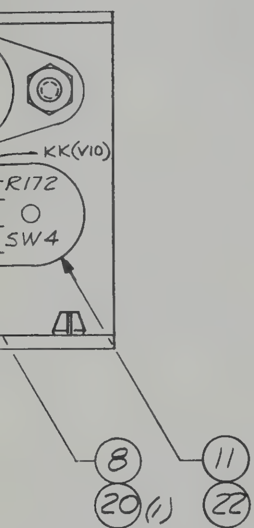
material N/A

title ASS'Y MAIN BD

model no. 130, 131, 136 | dwg no 130-010 131-010 136-010 | rev C

finish N/A


VCG
NOT USED IN MODEL 130
FREQ VERNIER
INTEGRATOR
HYS./OUTPUT SWITCH
SYNC OUT
POWER SUPPLY
SINE CONV
OUTPUT AMPL
DC OFFSET
115V-230V SWITCH (SHOWN IN 115V POSITION)
JUMPER USED ON MODEL 136 ONLY
NOT USED IN MODEL 136 EXCEPT R168
NOTES: UNLESS OTHERWISE SPECIFIED
1 * INDICATES MATCHED SET (R14, R18, R19, R21, R181, R27), (R118, R119), (R109, R110), (R103, R111), (R106, R108)
2 DIODES ARE FD6666
3 RESISTORS ARE CARBON 1/2W
4 C17, C18, C19, C20, C54 ARE A MATCHED SET
5 IC2: CA3039
6 IC2, IC4 & IC5 ARE SELECTED
7 ≠ INDICATES SELECTED VALUE; NOMINAL VALUE AS SHOWN
μA709C
CA3030
CA3036
CA3039
PIN 10 CONNECTED TO BASE
A1 (WAVETEK 130-011)
LAST DESIGNATOR USED
Q40
J1
CR18
C68
R184
B ECN 300
A REFER NO. 283
WAVETEK san diego, calif
SCHEMATIC - MAIN BD
model no 130, 131, 136
dwg no 130-210, 131-210, 136-210
rev B
date 7-19-69
This document contains proprietary information and design rights belonging to WAVETEK and may not be used or reproduced for any reason except calibration, operation and maintenance without written authorization.



PARTS LIST

ITEM	REF DES	DESCRIPTION	MFGR	MFGR NO	QTY	
1		BRACKET	WAVETEK	130-302	1	
2	T1	TRANSFORMER		130-500	1	
3		TRANSFORMER BRACKET		130-306	1	
4		STANDOFF (MODEL 130 ONLY)		137-318	2	
5	F1	FUSE, 1/4AMP-115V,	LITTELFUSE	312-250	1	FOR 115V MODEL
6		FUSE HOLDER		342012	1	
7		FUSE 1/8AMP, 230V		313-125	1	FOR 230V MODEL
8	J1	POWER RECEPTACLE	SWITCHCRAFT	AC3-G	1	
9						
10	R10	POT (MODEL 131+134 ONLY)	CTS	130-R1	1	
11	R172, SW4	DC OFFSET SWITCH 10K/SPDT	CTS	UL5186	1	
12	SW2	115-230V SWITCH	SWITCHCRAFT	46256LF	1	
13	SW1C+D	WAFER	CTS	130-SW1-3	2	
14						
15						
16	J3	BNC CONNECTOR	KING	KC7946	1	
17		SHOULDER WASHER	SMITH	2668	2	
18						
19		FASTENERS #6-32	BOOTS AIRCRAFT	T81D070	4	
20		SOLDER LUG	H. H. SMITH	1414-4	2	
21		SOLDER LUG		1497	1	
22		KNOB	ELMA	020-222	1	
23						
24						
25						

tolerance unless otherwise specified .XXX ± .010 .XX ± .030	rev	ecn	by	date	app.
	WAVETEK san diego, calif				
scale N/A	by BOCHICCHIO	date 7-21-69	app [illegible]		
material N/A	title ASS'Y, BRACKET				
finish N/A	model no. 130-134	dwg no. 130-001	rev		

INSTRUCTION MANUAL ADDENDUM
– for –
130 SERIES INSTRUMENTS
(Serial Numbered 080xxx and 090xxx up)

PURPOSE

To eliminate possible dial-mounting errors when using the push-on main frequency dial.

OPERATIONAL CHANGES

None.

CIRCUIT CHANGES

(1) A 6.8 MΩ (R184) has been installed between pin 4 of IC1 and the junction of R9 and R5.

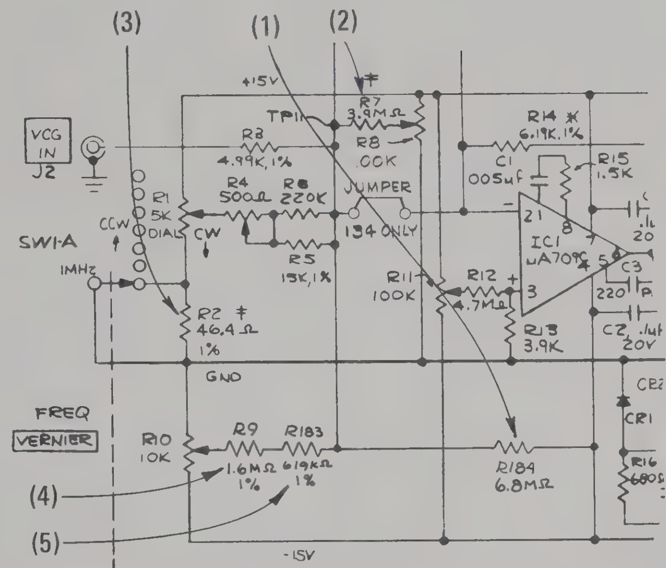
(2) Changed value of R7 from 6.8 MΩ to 3.9 MΩ.

(3) Changed value of R2 from 42.2 Ω to 46.4 Ω.

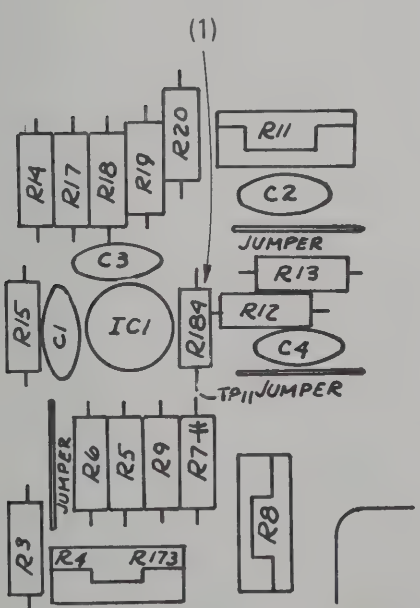
Units Serial Numbered 090xxx up

(4) Changed value of R9 from 1.6 MΩ to 1.0 MΩ ±1%.

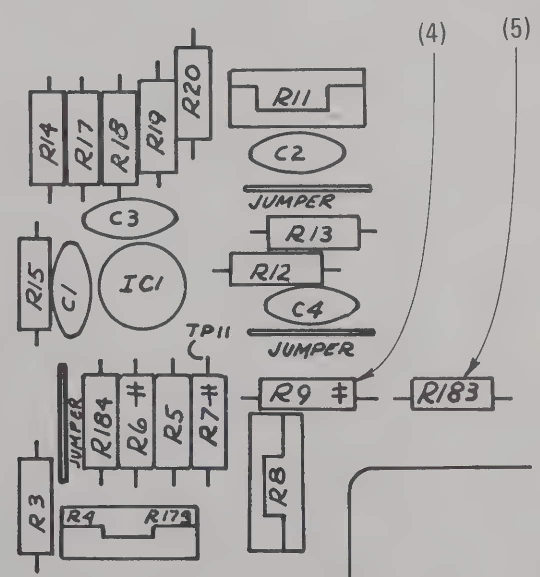
(5) A 619 kΩ (R183) has been installed between R9 and the junction of R5 and R184.



VCG Section of Main Board Schematic



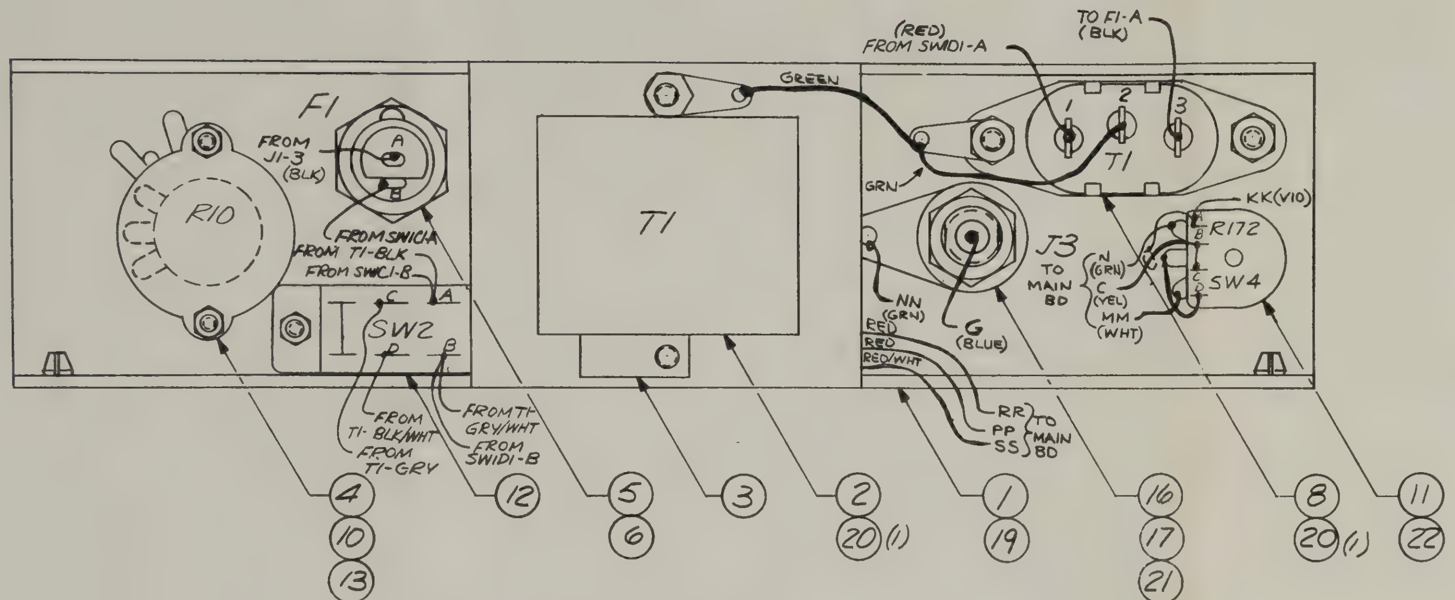
VCG Section of Main Board Assembly
(Units Serial Numbered 080xxx)



VCG Section of Main Board Assembly
(Units Serial Numbered 090xxx up)

CALIBRATION

Delete steps 3 and 4 of the Dial Alignment procedure and repeat steps 5 through 8 until proper indications are obtained.



PARTS LIST

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9						
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13	SW1C+D	WAFER	CTS	130-SW1-3	2	
14						
15						
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17		SHOULDER WASHER	SMITH	2668	2	
18						
19		FASTENERS #6-32	BOOTS AIRCRAFT	T810070	4	
20		SOLDER LUG	H.H. SMITH	1414-4	2	
21		SOLDER LUG		1497	1	
22		KNOB	ELMA	020-222	1	
23						
24						
25						

tolerance unless otherwise specified .XXX ± .010 .XX ± .030	rev	ecn	by	date	app.
	WAVETEK san diego, calif				
scale N/A	by BC CHK. HIO	date 7-21-69	app.		
material N/A	title ASS'Y, BRACKET				
finish N/A	model no. 130-134	dwg no. 130-001	rev		

INSTRUCTION MANUAL ADDENDUM
– for –
130 SERIES INSTRUMENTS
(Serial Numbered 080xxx and 090xxx up)

PURPOSE

To eliminate possible dial-mounting errors when using the push-on main frequency dial.

OPERATIONAL CHANGES

None.

CIRCUIT CHANGES

(1) A 6.8 MΩ (R184) has been installed between pin 4 of IC1 and the junction of R9 and R5.

(2) Changed value of R7 from 6.8 MΩ to 3.9 MΩ.

(3) Changed value of R2 from 42.2 Ω to 46.4 Ω.

Units Serial Numbered 090xxx up

(4) Changed value of R9 from 1.6 MΩ to 1.0 MΩ ±1%.

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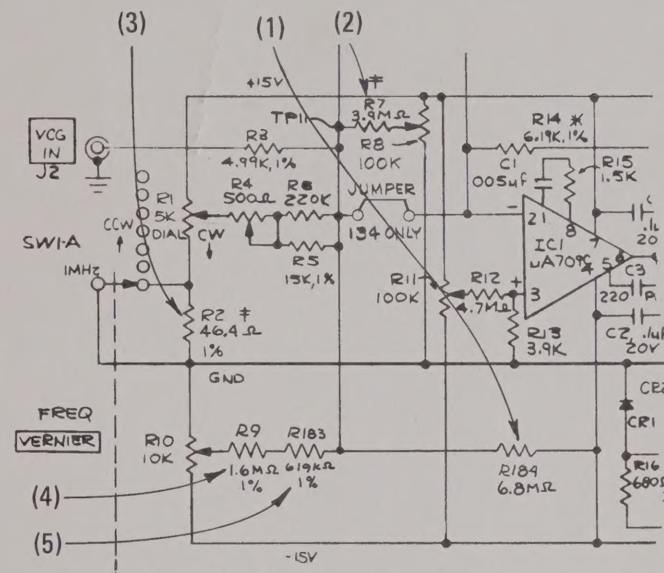
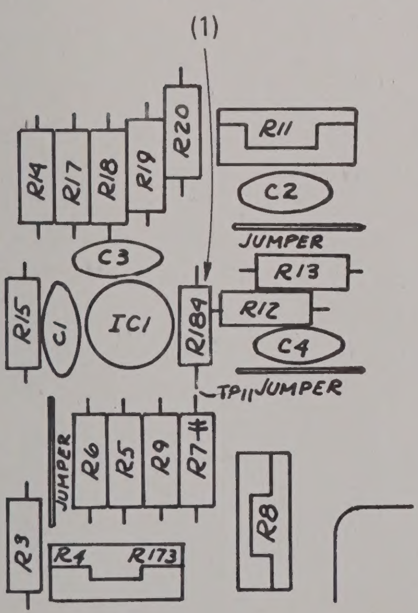
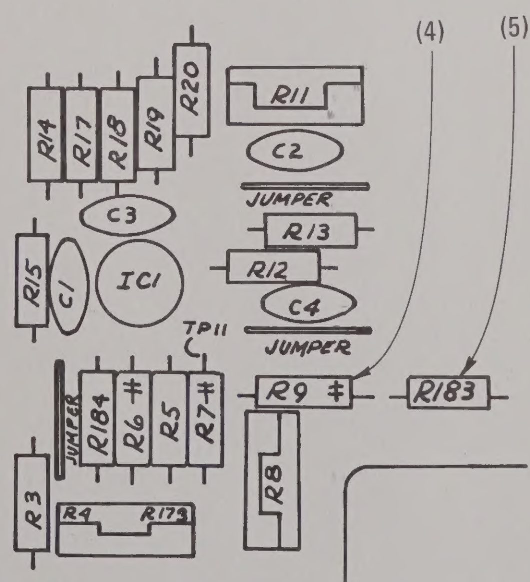


VCG Section of Main Board Schematic



VCG Section of Main Board Assembly
(Units Serial Numbered 080xxx)



VCG Section of Main Board Assembly
(Units Serial Numbered 090xxx up)

CALIBRATION

Delete steps 3 and 4 of the Dial Alignment procedure and repeat steps 5 through 8 until proper indications are obtained.